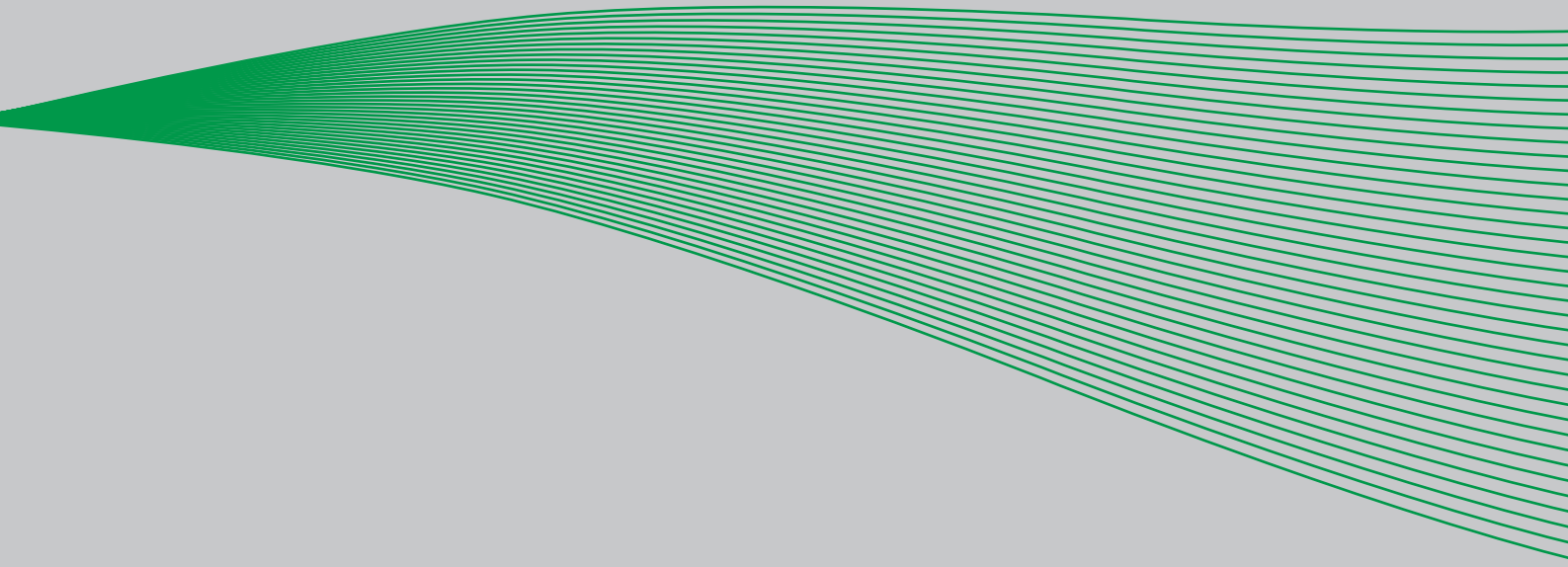
VACON 8000 SOLAR
POWER INVERTERS

3-PHASE PHOTOVOLTAIC INVERTERS

USER MANUAL



VACON
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INDEX

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1. SAFETY

1.1 DANGER AND WARNING SYMBOLS USED IN THIS MANUAL

This manual contains clearly marked cautions and warnings which are intended for your personal safety and to avoid any unintentional damage to the product or connected appliances.

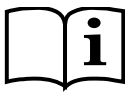
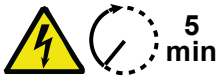
Please read the information included in cautions and warnings carefully.

The cautions and warnings are marked as follows:

	**= Dangerous voltage! Risk of electric shock**
	**= General warning! Risk of equipment damage**

1.2 SYMBOLS AND WARNING MARKS USED IN THE PRODUCT

The product carries some additional symbols and marks. The meanings of these are as follows:

	**= Dangerous voltage! Risk of electric shock**
	**= See User's Manual**
	**= Caution! Risk of electric shock!** Energy storage timed discharge: **5 minutes**
	**= Caution, risk of hearing damage, wear hearing protection**

1.3 SAFETY RULES

	**ONLY A COMPETENT ELECTRICIAN IS ALLOWED TO CARRY OUT THE ELECTRICAL INSTALLATION! RISK OF ELECTRIC SHOCK!**

The solar inverter VACON 8000 SOLAR has been designed to be installed in enclosed places. It shall be protected against harsh weather conditions.

The solar inverter VACON 8000 SOLAR can only be opened by qualified technicians. Inside the in-vert-er module, there is no element which can be fixed or adjusted by the user.

	There is a serious risk of electrick shock, even after the device has been discon-nected from the mains supply or solar panels. This electrick shok may cause death or serious injury.
	If the short circuit current of the grid is higher than the short circuit withstanding capability of the QA2, additional circuit breaker must be installed. if the possible short circuit current at the grid point of connection is higher than the solar inverter's breaking capacity, additional current limiting device must be installed (see chapter 5,3).
	If the equipment is used in a manner not specified by the manufacturer, the protec-tion provided by the equipment may be impaired.

Even when the solar inverter has been disconnected from mains and solar panels, wait until the con-trol panel switches off. After this, it is recommended that you wait at least 5 minutes before opening, and /or making any kind of alteration or connection to, the device.

Check that there is no voltage present before handling and performing any kind of work on the de-vice. To verify the absence of voltage, type III measurement elements (1000 volts) must be used.

Do not perform any measurement or test when the VACON 8000 SOLAR is connected to mains or solar panels.

Do not perform any kind of dielectric strength test on the VACON 8000 SOLAR. Unless the appropri-ate process is followed, performing this test may damage the inverter module.

Appropriate personal protective equipment (PPEs) must be used:

- Helmet
- Safety goggles for electrical risk
- Safety footwear
- Hearing protection
- Electrically resistant gloves adequate for the voltage
- Protective gloves against mechanical risk

	Access to the photo-voltaic field is strictly prohibited!

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1.4 EARTHING AND EARTH FAULT PROTECTION

	**CAUTION!**

The Vacon 8000 Solar inverter must always be earthed with an earthing conductor connected to the earthing terminal marked with ⏚.

The touch current of Vacon 8000 Solar exceeds 3.5mA AC. According to EN62109-1, one or more of the following conditions for the associated protective circuit shall be satisfied:

A fixed connection and

a) the **protective earthing conductor** shall have a cross-sectional area of at least 10 mm^2 Cu or 16 mm^2 Al.

or

b) an automatic disconnection of the supply in case of discontinuity of the **protective earthing conductor**. See chapter 4.

or

c) provision of an additional terminal for a second **protective earthing conductor** of the same cross-sectional area as the original **protective earthing conductor**.

Table 1.

Cross-sectional area of phase conductors (*S*) [mm^2]	**Minimum cross-sectional area of the corresponding protective earthing conductor**
$S \leq 16$ $16 < S \leq 35$ $35 < S$	S 16 $S/2$
The values above are valid only if the protective earthing conductor is made of the same metal as the phase conductors. If this is not so, the cross-sectional area of the protective earthing conductor shall be determined in a manner which produces a conductance equivalent to that which results from the application of this table.	

The cross-sectional area of every protective earthing conductor which does not form a part of the supply cable or cable enclosure shall, in any case, be not less than

- 2.5 mm^2 if mechanical protection is provided or
- 4 mm^2 if mechanical protection is not provided. For cord-connected equipment, provisions shall be made so that the protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.

However, always follow the local regulations for the minimum size of the protective earthing conductor.

NOTE: Due to the high capacitive currents present in the AC drive, fault current protective switches may not function properly.

	**Do not perform any voltage withstand tests** on any part of Vacon 8000 Solar. There is a certain procedure according to which the tests shall be performed. Ignoring this procedure may result in damaged product.

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2. TECHNICAL SPECIFIATIONS

2.1 Inverter ratings

Range of input voltages 410-800Vcc, 50/60 Hz, 3~									
Inverter type	Nom. output power [kW]	Recommended max PV power [kW]	Max allowed PV Isc [A]	Max efficiency [%]	Max Power consumption at night [W]	Inverter dimensions [mm]	Inverter weight [kg]	Connection cabinet [mm] (kg)	
								Incoming	Outgoing AC-cabinet (optional)
NXV0125	125	150	353	96.8	0	800x2281x600	450	[1]	N/A
NXV0200	200	240	613	98.6	0	800x2281x600	645	[1]	N/A
NXV0400	400	480	1226	98.6	60	1600x2281x600	1220	600 (205)	600 (215)
NXV0600	600	720	1839	98.6	60	2400x2281x600	1830	600 (205)	600 (215)
NXV0800	800	960	2452	98.6	60	3200x2281x600	2440	800 (355)	600 (320)
NXV1000	1000	1200	3065	98.6	60	4000x2281x600	3050	800 (355)	600 (320)
NXV1200	1200	1440	3678	98.6	60	4800x2281x600	3660	800 (355)	600 (320)

Table 2. Power ratings, dimensions and weights

2.2 TECHNICAL DATA

Table 3. Technical data

DC Input	Range of input voltages	410...800 VDC
	Maximum input voltage	900 VDC
AC input	Mains voltage	3*280±10%
	Galvanic isolation	No
	Frequency	50/60 Hz ±0,5%
	Cos φ	>0.99, for output 20%-100% of Pn
	Harmonic distortion	<3% at Pn
	Consumption at night	30W
	Maximum efficiency	98.6%
	Ambient temperature	-10...+40ºC; 1-% derating for each degree up to 50ºC required
	Relative humidity	<95% no condensation
	Protection	IP21
	Display	Alfanumeric display per unit with two lines of 14 characters, leds indicating functioning, plus fault and function push buttons. Units above and including NXV0400 also equipped with a PLC touch screen user interface.
	Signalling	3 potential free contacts to indicate faults and alarms
	Aux. supply (for units > 200kW)	230VAC, 16A MCB provided, 2,5...16 mm^2
	Communications	May include one of the following communication buses as an optional feature: Modbus RTU, Ethernet (Modbus/TCP), RS485, GPRS, string and inverter monitoring May include a monitoring system with http-access as an optional feature.
	Step-up transformer	Not included in delivery. Allowed types: DyN11 or YyN0, neutral should not be connected on inverter side Impedance voltage: Higher or equal to 6%
Ambient conditions	Altitude	Max. 2,000m
	Environmental category	Indoor, conditioned
Olvervoltage category	Pollution degree	PD2
	AC (Mains)	OVCIII
	AC (Aux.supply)	OVCII
	DC (Panels)	OVCII

[1]Inverter types NXV0125 and NXV0200 have an optional incoming connection box

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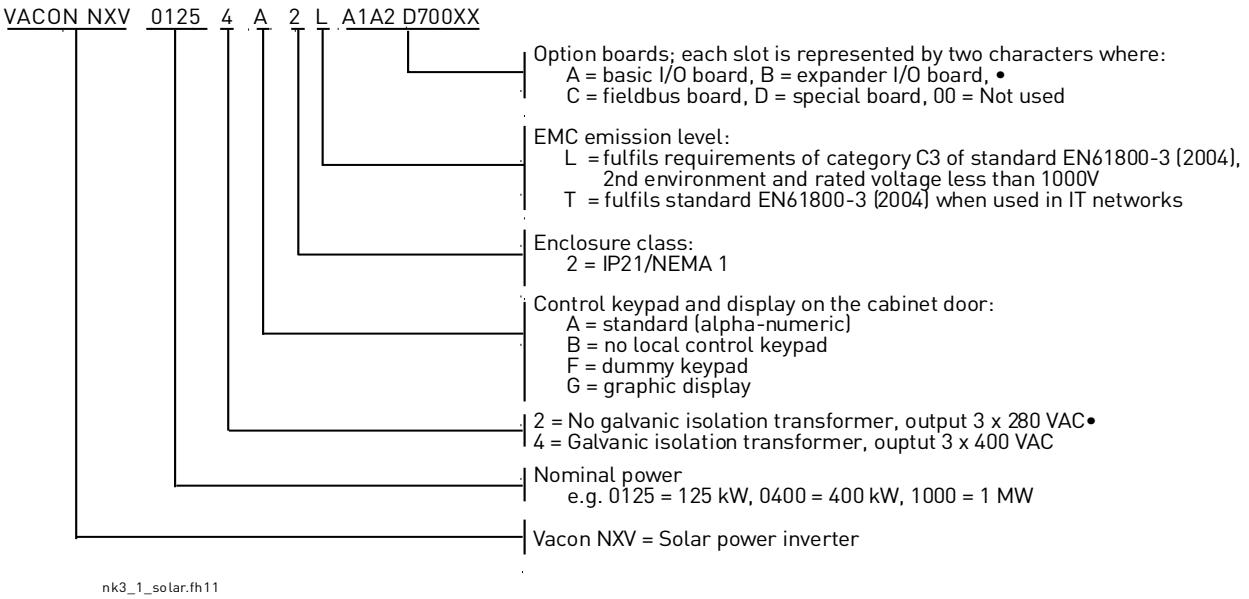
3. RECEIPT OF DELIVERY

3.1 TYPE DESIGNATION CODE

Vacon 8000 Solar inverters have undergone scrupulous tests and quality checks at the factory before they are delivered to the customer. However, after unpacking the product, check that no signs of transport damages are to be found on the product and that the delivery is complete (compare the type designation of the product to the code below).



3.2 LIFTING THE UNIT OUT OF THE TRANSPORT PACKAGING

Before unpacking the device, check the correctness of delivery by comparing your order data to the drive information found on the package label.

The unit is delivered either in a wooden box or a wooden cage. The box may be transported either horizontally or vertically, while transportation of the cage in a horizontal position is not allowed. Always refer to shipping marks for more detailed information. To lift the unit out of the box, use lifting equipment capable of handling the weight of the cabinet.

There are lifting lugs on the top of the cabinet and these lugs can be used to lift the cabinet into an upright position and to move it to the place needed.

Units NXV 0125 and NXV0200 may be lifted as shown in Figure 3-2, in vertical or horizontal position. However, bigger units (NXV0400 to NXV1200) must always be lifted in vertical position, see Figure 3-3.

Figure 1.Lifting 1-cabinet unit

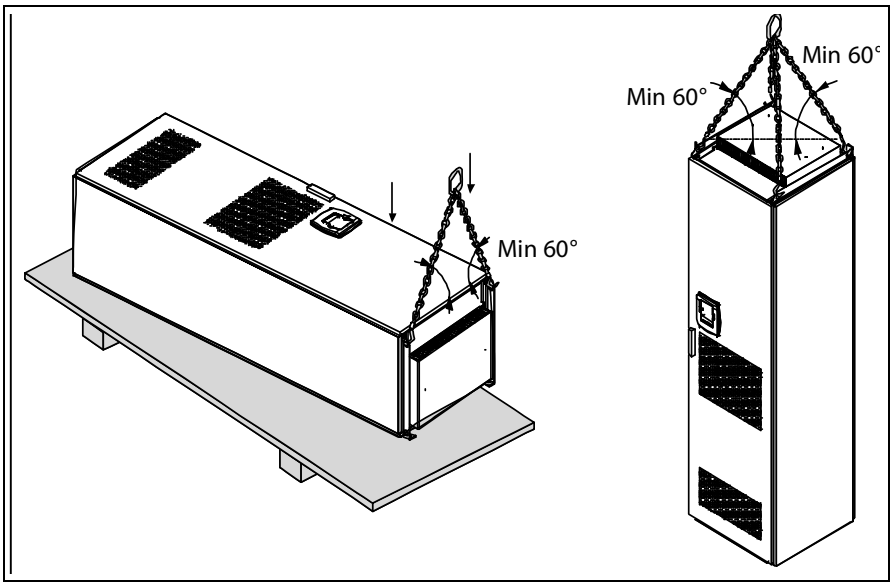


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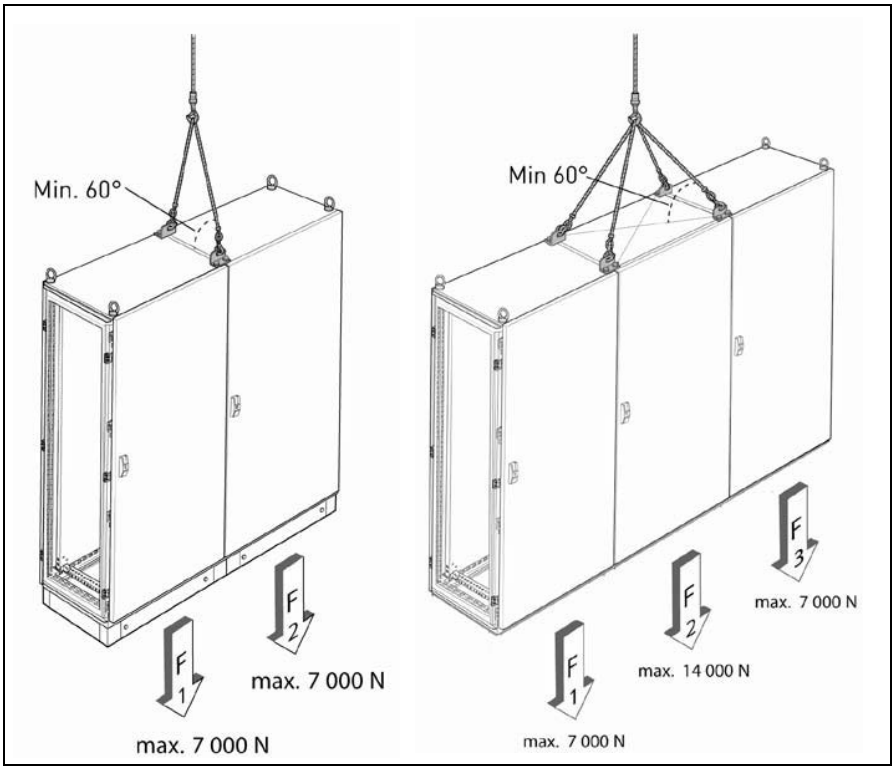
Figure 2.Lifting several-cabinet units



After unpacking the product, check that no signs of transport damages are to be found on the product and that the delivery is complete.

If the delivery does not correspond to your order, contact the supplier immediately.

Should the drive have been damaged during the shipping, please contact primarily the cargo insurance company or the carrier.

If the equipment has been damaged, do not install it.

Keep the original packaging in case it is necessary to return the equipment to the manufacturer. Otherwise recycle the packaging material according to local regulations.

3.3 STORAGE

If the inverter is to be kept in store before use make sure that the ambient conditions are acceptable:

Storing temperature -40...+70°C
Relative humidity <95%, no condensation

The environment should also be free from dust. If there is dust in the air the inverter should be well protected to make sure dust does not get inside it.

If the inverter is to be stored during longer periods the power should be connected to the inverter once in 24 months and kept on for at least 2 hours. If the storage time exceeds 24 months the electrolytic DC capacitors need to be charged with caution. Therefore, such a long storage time is not recommended.

If the storing time is much longer than 24 months, the recharging of the capacitors has to be carried out so that the possible high leakage current through the capacitors is limited. The best alternative is to use a DC-power supply with adjustable current limit. The current limit has to be set for example to 300...500mA and the DC-power supply has to be connected to the B+/B- terminals (DC supply terminals).

DC-voltage must be adjusted to nominal DC-voltage level of the unit (1.35*Un AC) and supplied at least for 1 hour.

If DC-voltage is not available and the unit has been stored de-energized much longer than 1 year consult factory before connecting power.

3.4 MAINTENANCE

Please contact Vacon service for recommended maintenance schedule.

3.5 WARRANTY

Only manufacturing defects are covered by the warranty. The manufacturer assumes no responsibility for damages caused during or resulting from transport, receipt of the delivery, installation, com-missioning or use.

The manufacturer shall in no event and under no circumstances be held responsible for damages and failures resulting from misuse, wrong installation, unacceptable ambient temperature, dust, corrosive substances or operation outside the rated specifications.

Neither can the manufacturer be held responsible for consequential damages.

The Manufacturer's standard time of warranty is 18 months from the delivery or 12 months from the commissioning whichever expires first (Vacon Warranty Terms).

The local distributor may grant a warranty time different from the above. This warranty time shall be specified in the distributor's sales and warranty terms. Vacon assumes no responsibility for any oth-er warranties than that granted by Vacon itself.

In all matters concerning the warranty, please contact first your distributor.

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4. INSTALLATION

The installation of the VACON 8000 SOLAR solar inverter may only be carried out by a qualified technician
who fully understands the safety and installation instructions included in this manual.
The IP21 protection of the VACON 8000 SOLAR inverter only allows for installation in enclosed places.
Note the locations of some essential components of the inverters in pictures below:

Figure 3.NXV0125 inverter mocule (standalone) and some essential components

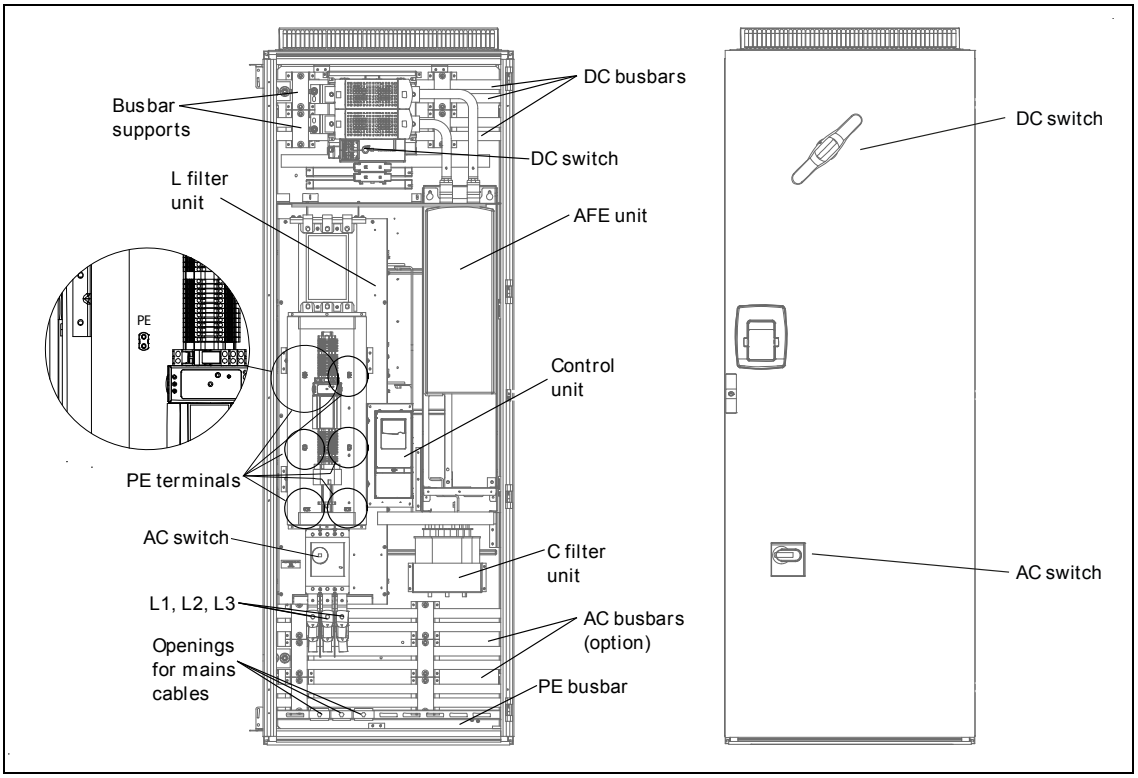


Figure 4.NXV0200 inverter module (standalone) and some essential components

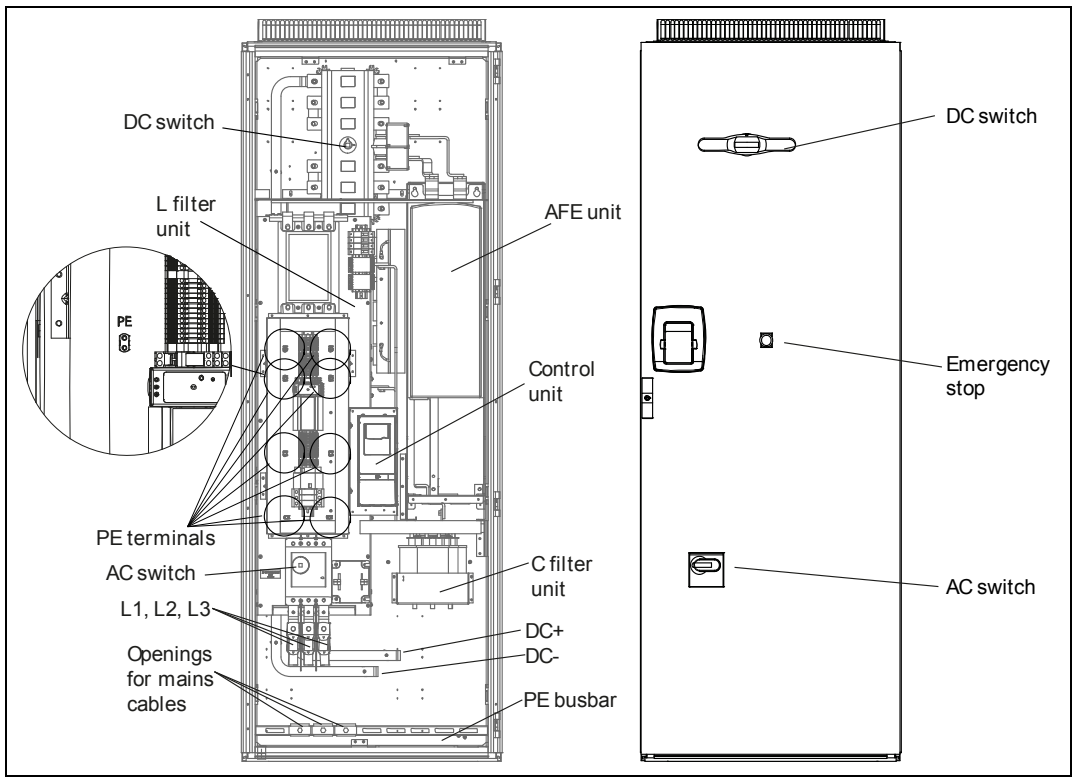
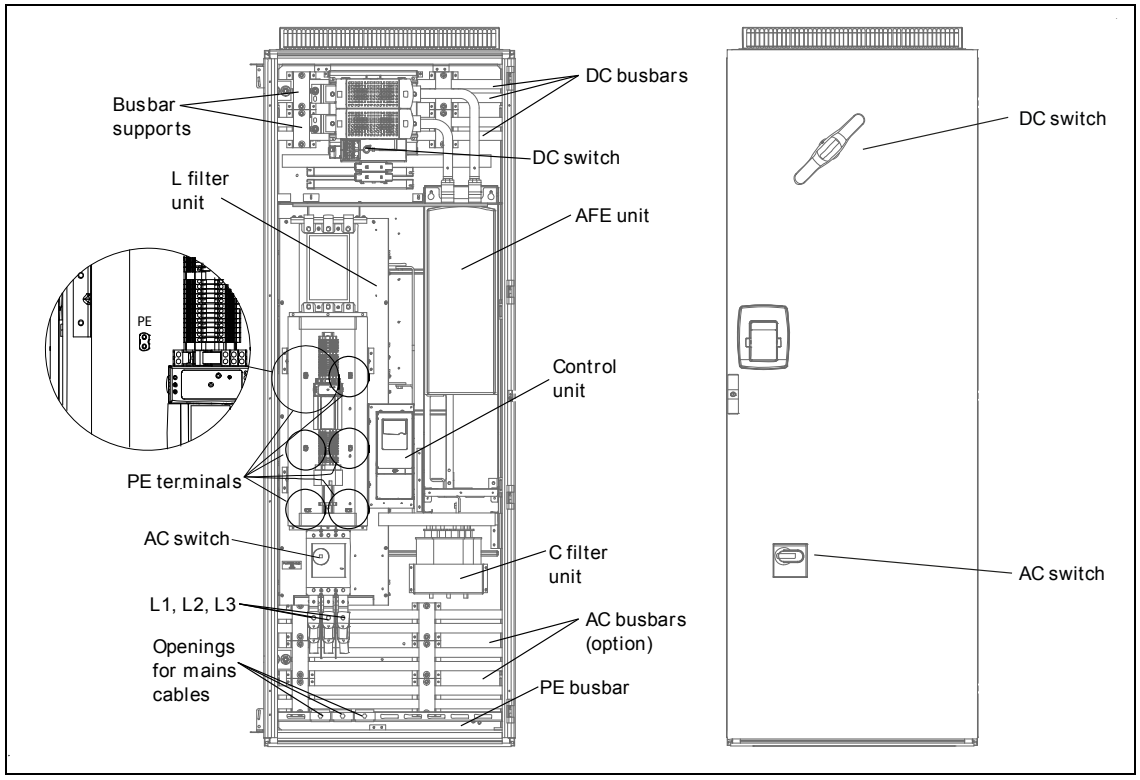


Figure 5.NXV0200 inverter module (line unit) and some essential components



Due to the heavy weight of the device, it must be placed on a firm and horizontal surface.
The equipment has to be installed in a place where the room temperature is between -10ºC and +40ºC. Lower temperatures prevent the equipment from starting up and higher temperatures limit the output power.

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The buzzing noise occurring during the operation of the equipment is normal. Do not install the equipment in an occupied dwelling.

	**NOTE:** It is important to prevent small particles falling onto the device. Small particles may enter the equipment through the ventilation grids and damage the equipment.
	Do not block the ventilation grids.
	Unit must be installed on non-flammable ground.
	The unit is not intended for wet location.

4.1 FREE SPACE AROUND THE CABINET

Enough space must be left above, behind and in front of the cabinet to ensure sufficient cooling and space for maintenance.
The amount of cooling air required is indicated in the table below. Also make sure that the temperature of the cooling air does not exceed the maximum ambient temperature of the inverter.

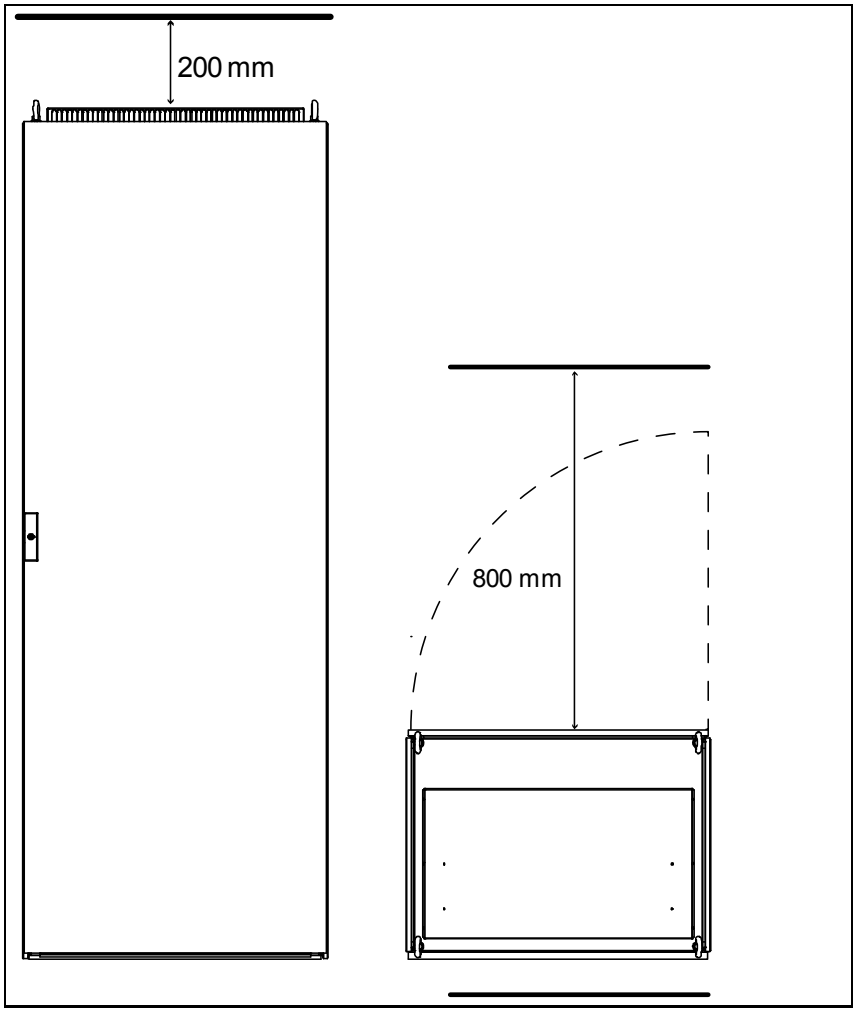

Figure 6. Space to be left free above (left) and in front of (right) the cabinet

Type	Cooling air required [m³/h]
NXV0125	800
NXV0200	1000
NXV0400	2000
NXV0600	3000
NXV0800	4000
NXV1000	5000
NXV1200	6000

Table 4. Required cooling air

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4.2 FIXING THE UNIT TO THE FLOOR

The cabinet should always be fixed to the floor. There are holes in all four corners to be used for fixing, see Figure 4-5.

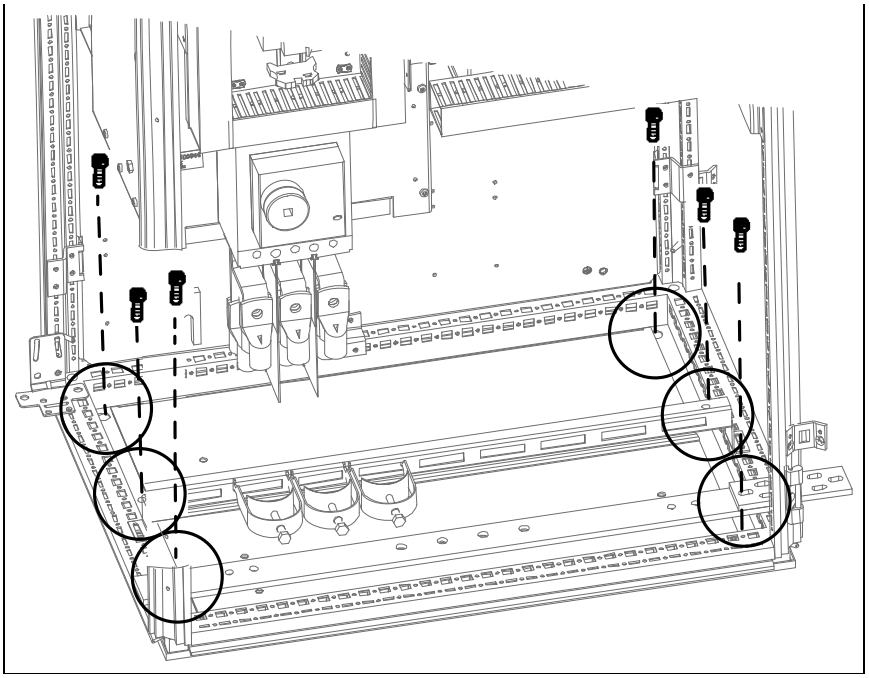


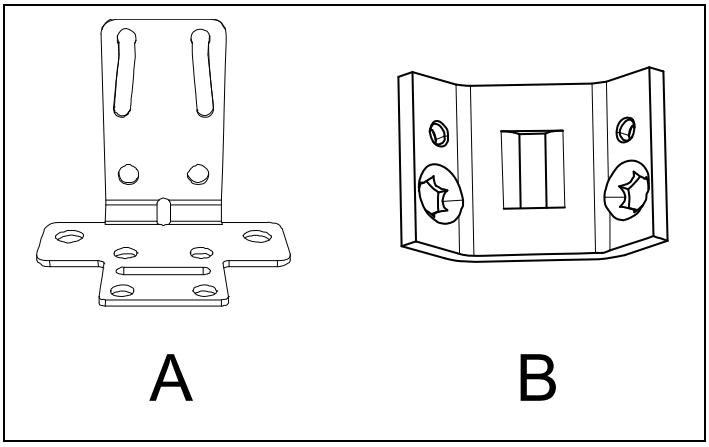
Figure 7.Fixing the cabinet to the floor

	Welding of the cabinet might risk sensitive components in the converter. Ensure that no grounding currents can flow through any part of the converter.

4.3 FIXING CABINETS TO EACH OTHER

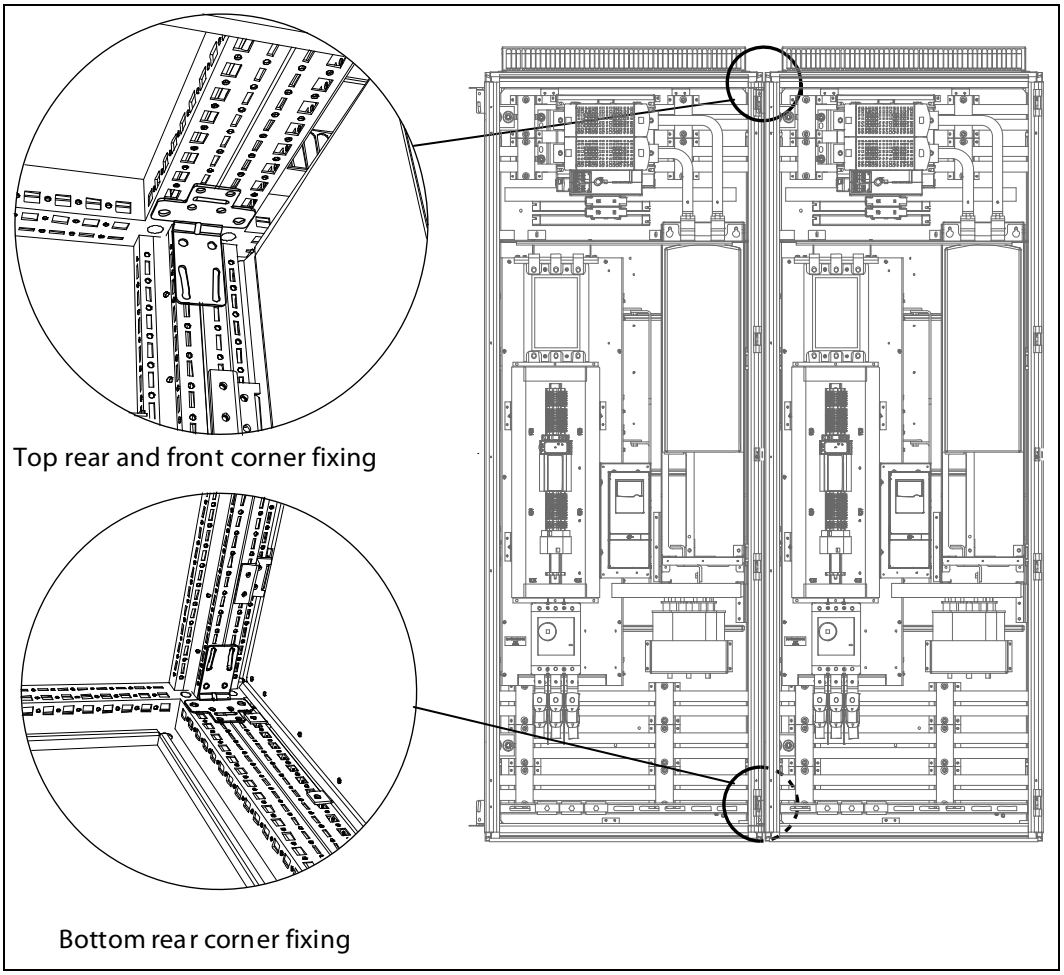
In case the delivery consists of several cabinets sections including drives the cabinets must be joined to each other. This will take place by 1) connecting the PE bars and 2) using the components of accessories kit attached to the delivery. To join two cabinet sections to each other you will need 3 *angular baying brackets* (A) and *6 quick-fit baying clamps* (B) (see Figure4-6 below).

Figure 8.Baying brackets



The angular baying brackets are used in **top rear** and **top front** as well as **bottom rear** corners of the cabinet.

Figure 9.Fixing corners



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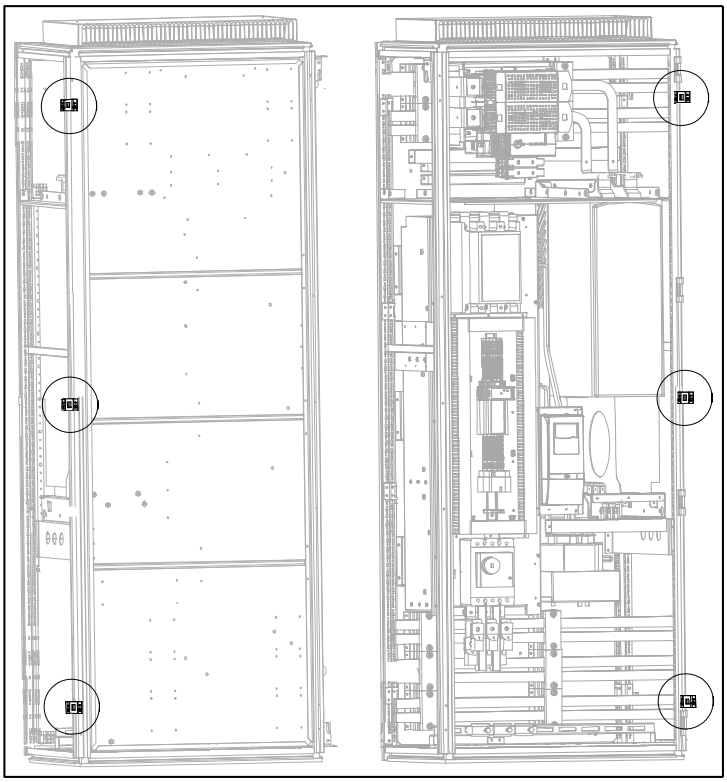
Use the quick-fit baying clamps to join the cabinets at points approximately shown in picture on the right.

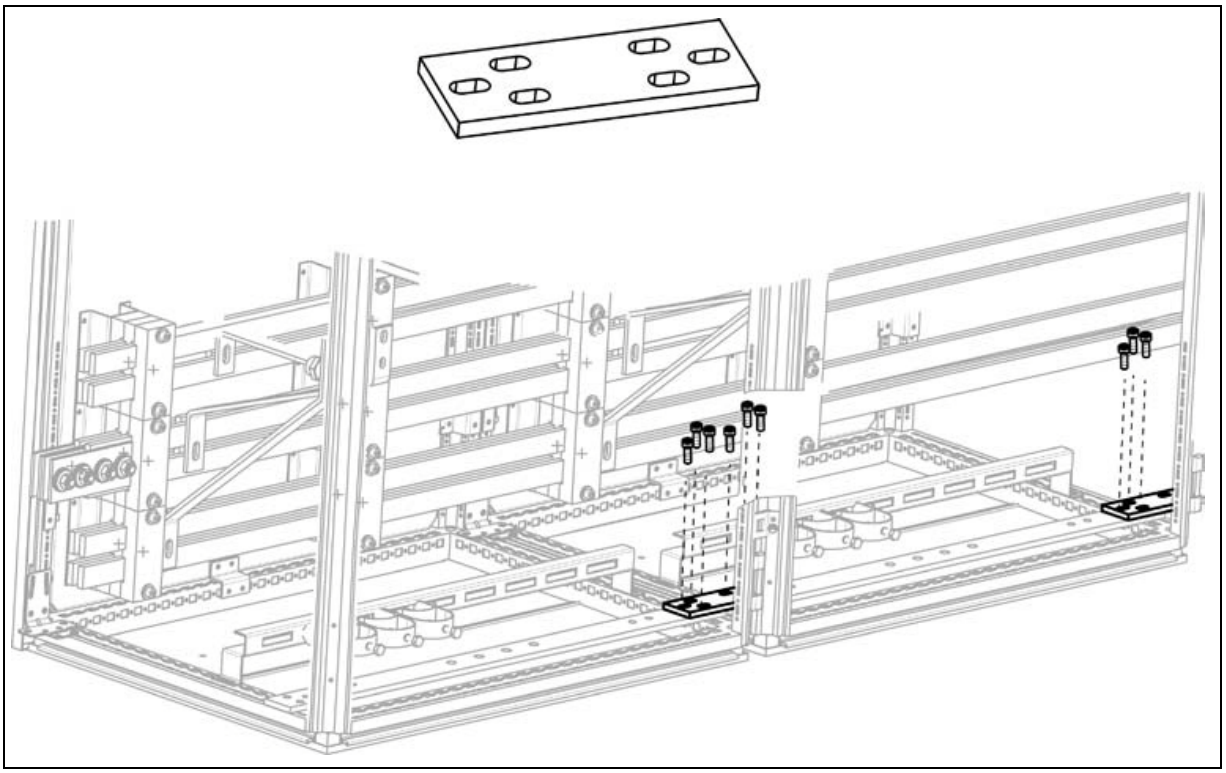
Figure 10.Cabinet fixing points



Note! Attach the baying clamps from the inside!

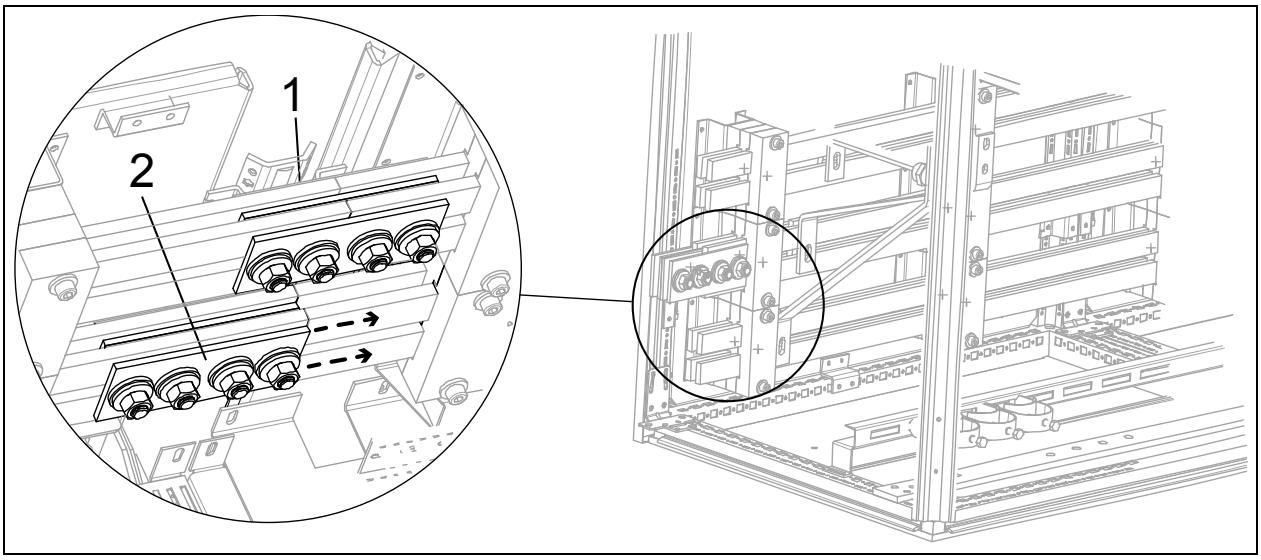
Finally join together the PE busbars (Figure 4-9) as well as AC or DC bars (Figure 4-10) by bolting together the baying bracket of the one and the busbar of the other cabinet.

Figure 11.Joining the PE bars



In Figure 4-10 right, the connection is not yet made. In the magnification (left), the connection of the upper bars is complete (1) and the lower bars shall be connected by sliding the longitudinal busbar connector (2) to the right on the busbar joint and tightening the bolts.

Figure 12.Joining the AC or DC bars (AC bars in this exaple)



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5. ELECTRICAL CONNECTION

	**Only a competent electrician is allowed to install the electrical connection. The equipment uses dangerous voltages.** **There is danger of electrical shock which may cause death or serious injury.**

5.1 ELECTRICAL DIAGRAMS

Figure 13.Electrical diagram for NXV0125

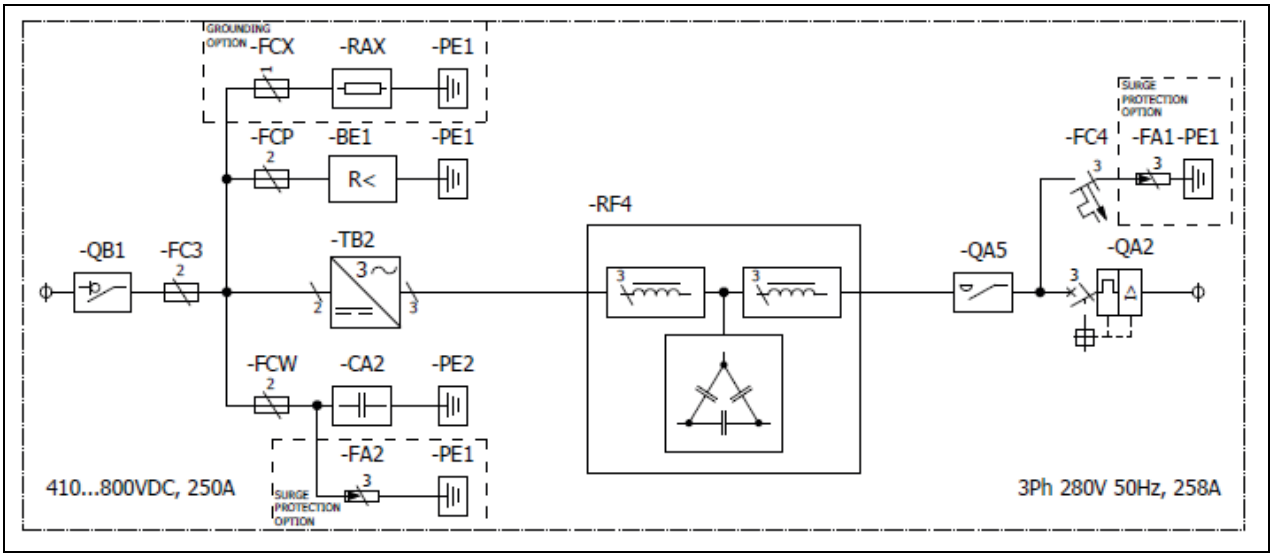
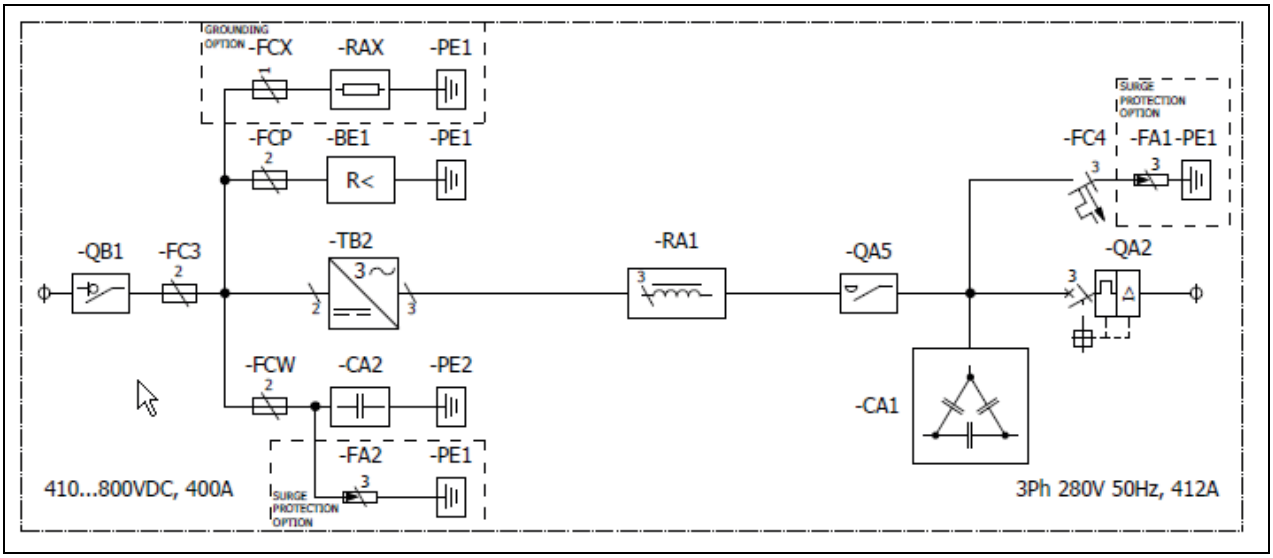


Figure 14.Electrical diagram for NXV0200



For larger types see Appendix A

5.2 CABLING

Before connecting the cables to the solar inverter, use a multimeter to check that the cables to be connected are not live.

Cables coming from photovoltaic panels will be active while panels are lit.

The tightening torques of **all** power connections are given in table below:

Table 5. Tightening torques of power connections

Screw/Bolt size	Tightening torque [Nm]
M6	8...10
M8	18...22
M10	35...45
M12	65...75

5.2.1 EARTH CONNECTION

The solar inverter has an earth connection terminal to which all the inverter's metallic parts are connected. This connection terminal must be connected to earth. After the PE busbars have been joined together as instructed in chapter 4.3, the PE busbar must be earthed. See appendix B.

5.2.2 CONNECTION TO MAINS

The terminals of the power supply can be reached through the bottom part of the equipment. The solar inverter has three connection terminals, to which mains cables are connected.

Make openings for the cables in the grommets on the bottom of the cabinet and lead through the cables. See Figure 5-5.

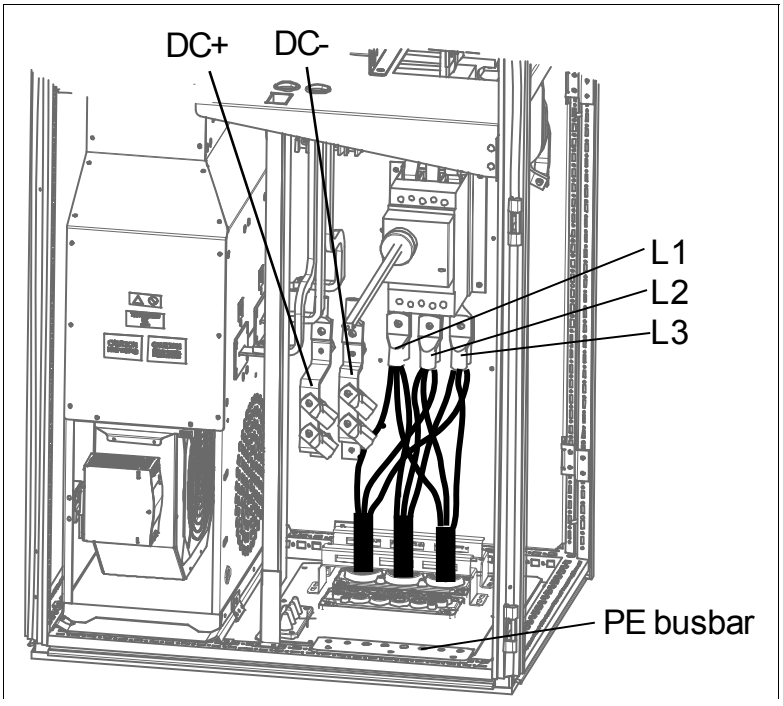


Figure 15.Main cabling NXV0125 standalone unit (cable clamps not included in delivery)

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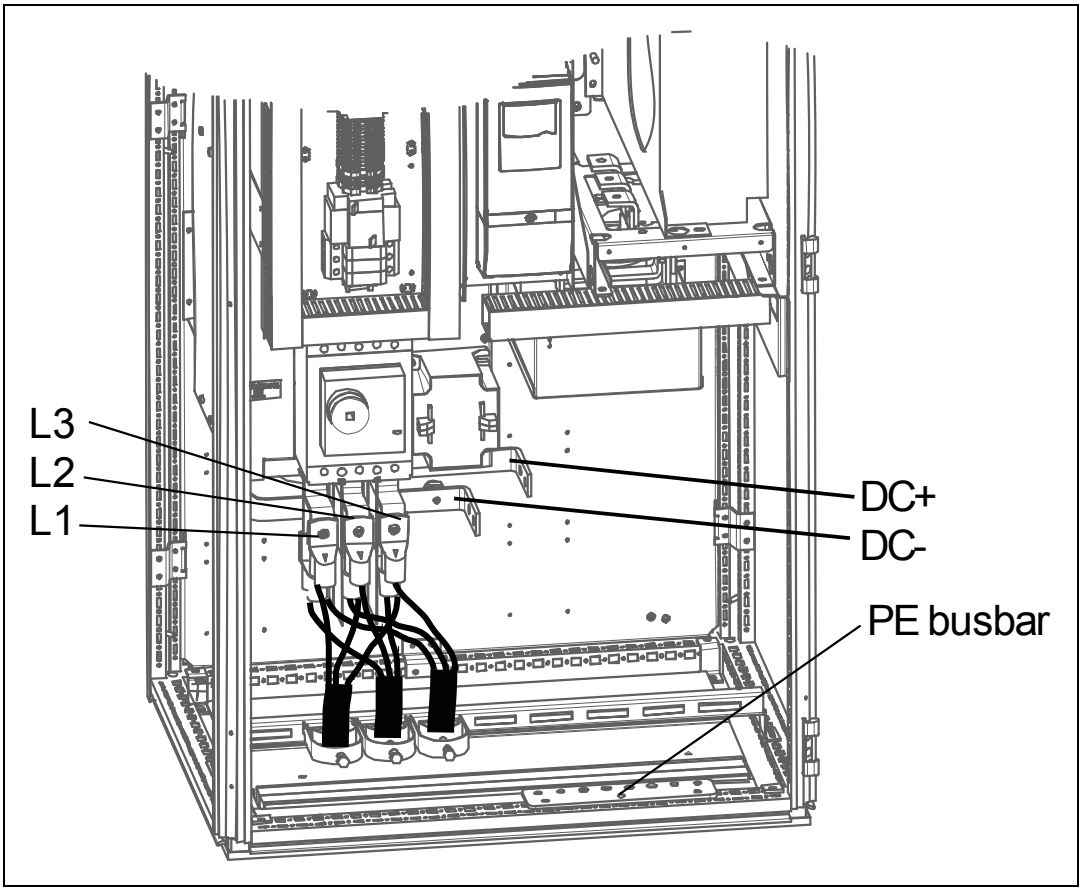

Figure 16. Main cabling NXV0200 standalone unit (cable clamps not included in delivery)

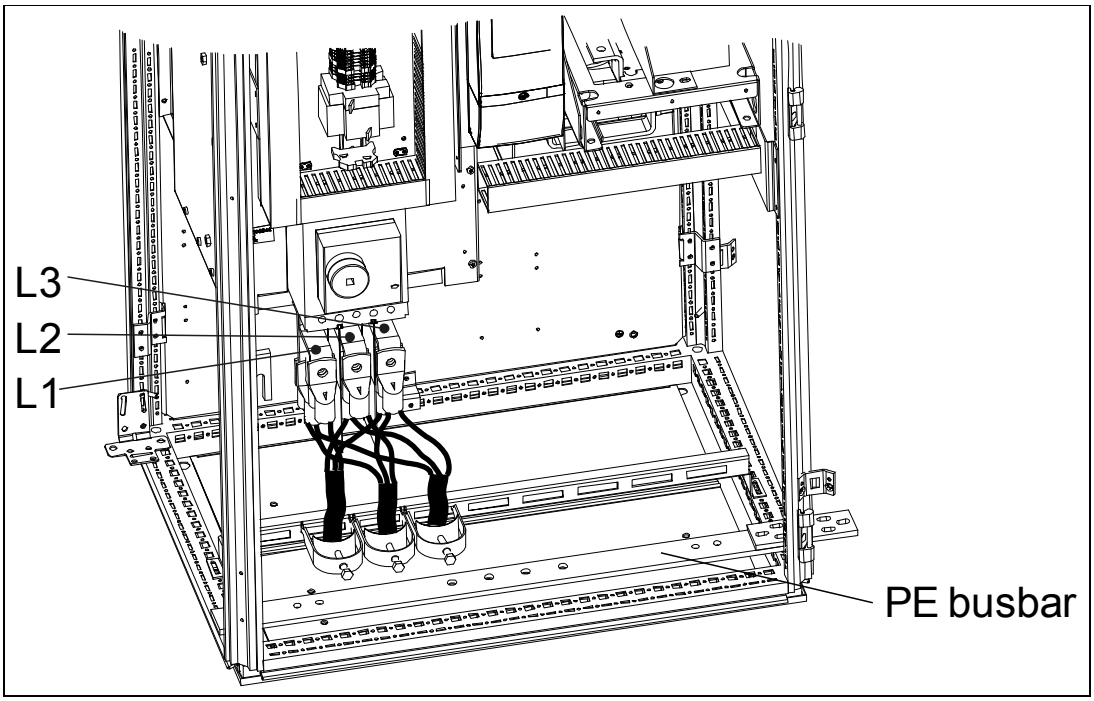

Figure 17. Mains cabling NXV0200 line unit (cable clamps not included in delivery)

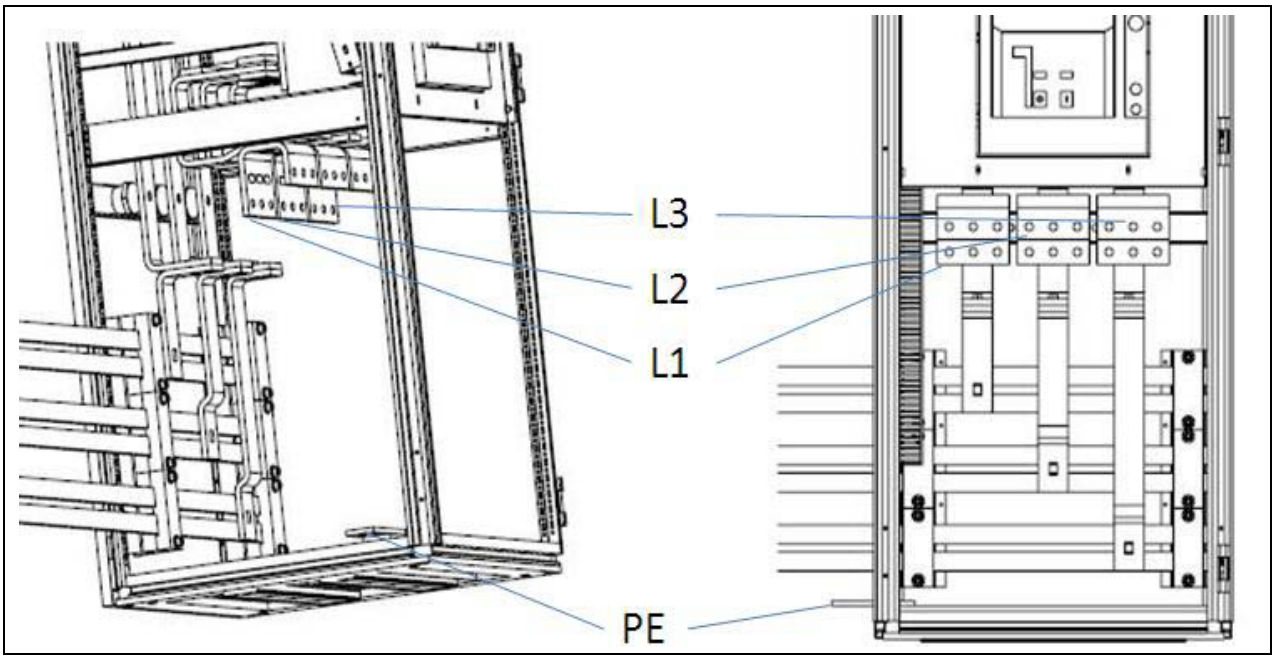

Figure 18. Main cabling with optional AC-section

The cable cross section will be determined according to the power and distance to the connection point, following the local regulations.

Model	Minimum cross section per unit [mm²]	Maximum cross section per unit [mm²]
All	10	240

5.2.3 CONNECTION TO PHOTOVOLTAIC PANELS

	**Remember** that photovoltaic panels produce a current while they are illuminated. Be sure to check that cables are not live.
	**NOTE!** Wrongly connected cables may damage the equipment.

Run the solar panel cables to the respective terminals on the drive through the bottom of the supply unit (see Figure 5-6 left). Check for the cable sizes and the appropriate number of cables in tables on page 25. Always connect the two cables on both sides of the terminal bar (see Figure 5-6 right).

Connect the positive pole of the photovoltaic panel to the terminal marked with '+' and the negative pole to the terminal marked with '-'.

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Figure 19.Inverter connection to solar panels (units below NXV0800)

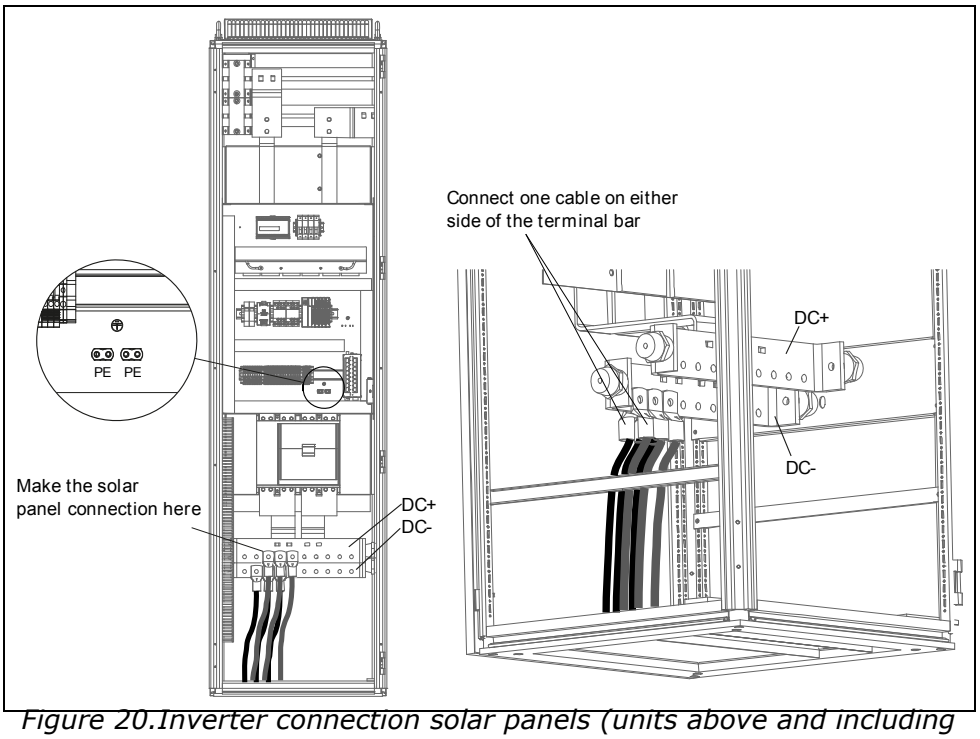

Figure 20.Inverter connection solar panels (units above and including NXV0800)

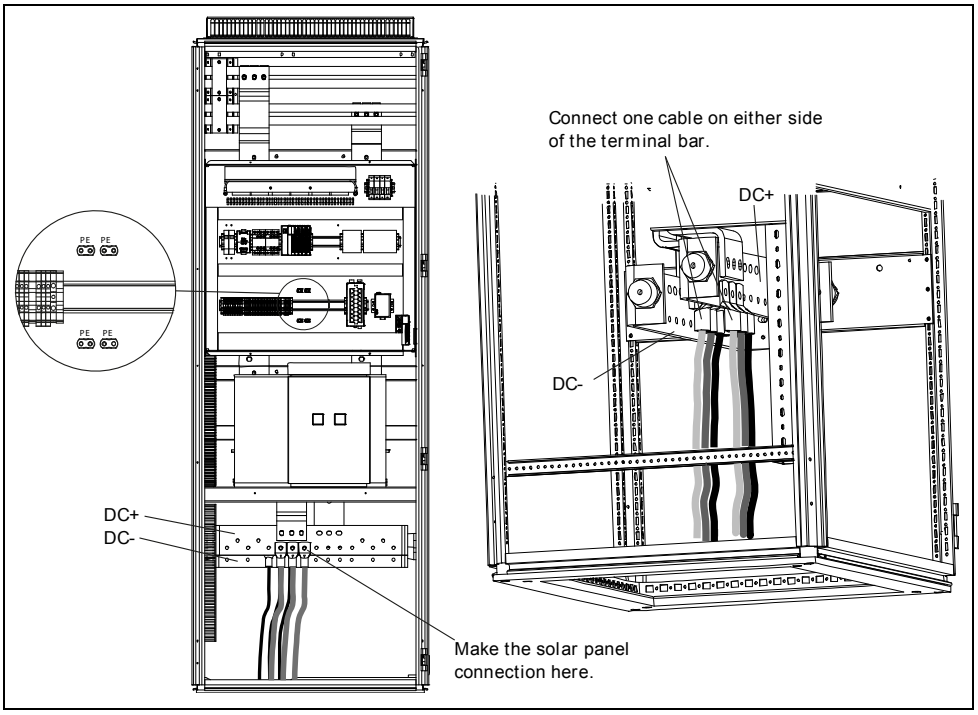

Table 6. Panel input cable dimensions

Model	Minimum cross section	Recommended cross section	Maximum cross section
NXV0125	3x 2x70mm²	3x 2x95mm²	4x 2x185mm²
NXV0200	4x 2x95mm²	4x 2x95mm²	4x 2x240mm²
NXV0400	8x 2x95mm²	8x 2x95mm²	20x 2x185mm²
NXV0600	12x 2x95mm²	12x 2x95mm²	20x 2x185mm²

Table 6. Panel input cable dimensions

Model	Minimum cross section	Recommended cross section	Maximum cross section
NXV0800	15x 2x95mm²	16x 2x95mm²	32x 2x185mm²
NXV1000	19x 2x95mm²	20x 2x95mm²	32x 2x185mm²
NXV1200	23x 2x95mm²	24x 2x95mm²	32x 2x185mm²

Table 7. Panel output cable dimensions

Model	Minimum cross section	Recommended cross section	Maximum cross section
NXV0125	2x 3x95mm²	2x 3x120mm²	2x 3x240mm²
NXV0200	3x 3x95mm²	2x 3x185mm²	4x 3x240mm²
NXV0400	6x 3x95mm²	4x 3x185mm²	12x 3x240mm²
NXV0600	9x 3x95mm²	6x 3x185mm²	12x 3x240mm²
NXV0800	12x 3x95mm²	8x 3x185mm²	16x 3x185mm²
NXV1000	15x 3x95mm²	10x 3x185mm²	16x 3x185mm²
NXV1200	17x 3x95mm²	2x 3x185mm²	16x 3x185mm²

Table 8. Panel earthing cable dimensions

Model	Cross section
NXV0125	50mm²
NXV0200	50mm²
NXV0400	50mm²
NXV0600	50mm²
NXV0800	50mm²
NXV1000	50mm²
NXV1200	50mm²

The minimum cable cross section is calculated in compliance with loading capacity of cables. The recommended cross section is calculated in compliance with 1-% voltage drop for a cable 100 m in length on DC-side and 50 m in length on AC-side.

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5.3 FUSE SELECTION

The table below shows typical cable sizes and types that can be used with the Vacon 8000 Solar inverter. The final selection should be made according to local regulations, cable installation conditions and cable specification.

CAUTION! Maximum AC-side short-circuit breaking capacity I_{cu}=30kA.
With optional AC-section I_{cu}=40kA.

5.3.1 FUSES FOR INVERTERS

Inverter type	Nominal current [A]	Nominal voltage [V]	Braking capacity [kA]	Acting behaviour	Fuse size	Suitable fuse type (Cat. nr by Ferraz-Shawmut
NXV0125	400	810	125	aR	71 DIN110	PC71UD13C400D1A
NXV0200	630	930	125	aR	73 DIN110	PC73UD13C630D1A
NXV0400	630	930	125	aR	DIN3	PC73UD13C630PA
NXV0600	630	930	125	aR	DIN3	PC73UD13C630PA
NXV0800	630	930	125	aR	DIN3	PC73UD13C630PA
NXV1000	630	930	125	aR	DIN3	PC73UD13C630PA
NXV1200	630	930	125	aR	DIN3	PC73UD13C630PA

Table 9. Fuse selection; suitable fuses for Vacon 8000 Solar inverter types

5.3.2 FUSE FOR CHARGING

Nominal current [A]	Nominal voltage [V]	Braking capacity [kA]	Acting behaviour	Fuse size	Suitable fuse type (Cat. nr by Ferraz-Shawmut
32	810	125	aR	DIN00	NH00UD10C32P

Table 10. Fuse selection, fuse for charging

5.3.3 FUSE FOR EMC CAPACITORS

Nominal current [A]	Nominal voltage [V]	Braking capacity [kA]	Acting behaviour	Fuse size	Suitable fuse type (Cat. nr by Ferraz-Shawmut
25	1000	10	gPV	10*38	HP10M4

Table 11. Fuse selection, fuse for EMC capacitors

5.3.4 Fuse for measuring

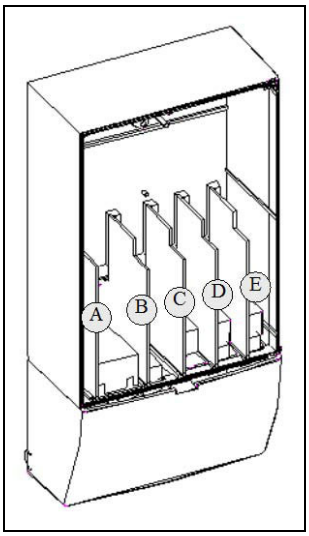
Nominal current [A]	Nominal voltage [V]	Braking capacity [kA]	Acting behaviour	Fuse size	Suitable fuse type (Cat. nr by Ferraz-Shawmut
4	1000	10	gPV	10*38	HP10M4

Table 12. Fuse selection, fuse for measuring

5.4 Control connections

The control boards are situated inside the control unit of the Vacon 8000 Solar inverter (see Figure 5-8). Four different board types can be used with the inverter: A1, A2, B5, C2, D2, D7 and CI. The control connections of these boards are described below. For more detailed information on the boards you can find in Vacon Option Board Manual.

Figure 21.Board slots in control unit



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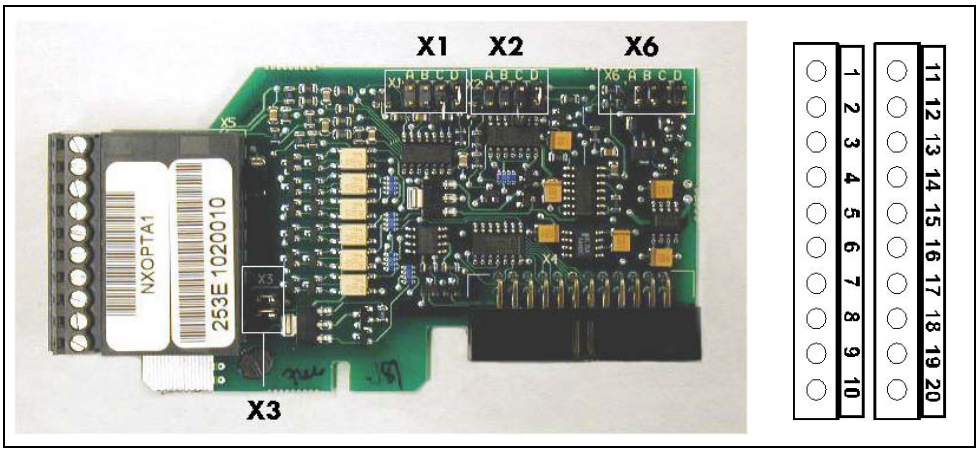
5.4.1 Basic board OPTA1

Figure 22.Vacon OPT-A1 option board



Description:	Standard I/O board with digital inputs/outputs and analogue inputs/outputs
Allowed slots:	A
Type ID:	16689
Terminals:	Two terminal blocks (coded = mounting of blocks in wrong order prevented, terminals #1 and #12); Screw terminals (M2.6)
Jumpers:	4; X1, X2, X3 and X6 (See Figure 5-10.)
Board parameters:	Yes (see page 31)

	Terminal	Parameter reference on keypad and NCDrive	Technical information
1	+10 Vref		Reference output +10V; Maximum current 10 mA
2	AI1+	An.IN:A.1	Selection V or mA with jumper block X1 (see page 30): Default: 0– +10V (Ri = 200 kΩ) (-10V..+10V Joy-stick control, selected with ajumper) 0– 20mA (Ri = 250 ?) Resolution 0.1%; Accuracy ±1% 3 AI1– Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
3	AI1–		
4	AI2+	An.IN:A.2	Selection V or mA with jumper block X2 (see page 30): Default: 0– 20mA (Ri = 250Ω) 0– +10V (Ri = 200 kΩ) (-10V..+10V Joy-stick control, selected with a jumper) Resolution: 0.1%; Accuracy ±1% 5 AI2– Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
5	AI2–		
6	24 Vout (bidirectional)		24V auxiliary voltage output. Short-circuit protected. ±5%, maximum current 150 mA +24Vdc external supply may be connected. Galvanically connected to terminal #12.
7	GND		Ground for reference and controls Galvanically connected to terminals #13,19.
8	DIN1	DigIN:A.1	Digital input 1 (common CMA); R_i = min. 5Ω
9	DIN2	DigIN:A.2	Digital input 2 (common CMA); R_i = min. 5Ω
10	DIN3	DigIN:A.3	Digital input 3 (common CMA); R_i = min. 5Ω
11	CMA		Digital input common A for DIN1, DIN2 and DIN3. Connection by default to GND. Selection with jumper block X3 (see page 30):
12	24 Vout (bidirectional)		Same as terminal #6 Galvanically connected to terminal #6.
13	GND		Same as terminal #7 Galvanically connected to terminals #7 and 19
14	DIN4	DigIN:A.4	Digital input 4 (common CMB); R_i = min. 5Ω
15	DIN5	DigIN:A.5	Digital input 5 (common CMB); R_i = min. 5Ω
16	DIN6	DigIN:A.6	Digital input 6 (common CMB); R_i = min. 5Ω
17	CMB		Digital input common B for DIN4, DIN5 and DIN6. Connection by default to GND. Selection with jumper block X3 (see page 30):
18	AO1+	AnOUT:A.1	Analogue output
19	AO1–		Output signal range: Current 0(4)–20mA, R_L max 500Ω or Voltage 0—10V, R_L >1kΩ Selection with jumper block X6 (see page 30): Maximum Resolution: 0.1% (10 bits); Accuracy ±2%
20	DO1	DigOUT:A.1	Open collector output Maximum U_{in} = 48VDC Maximum current = 50 mA

Table 13. I/O terminals on OPTA1 (coded terminals painted black)

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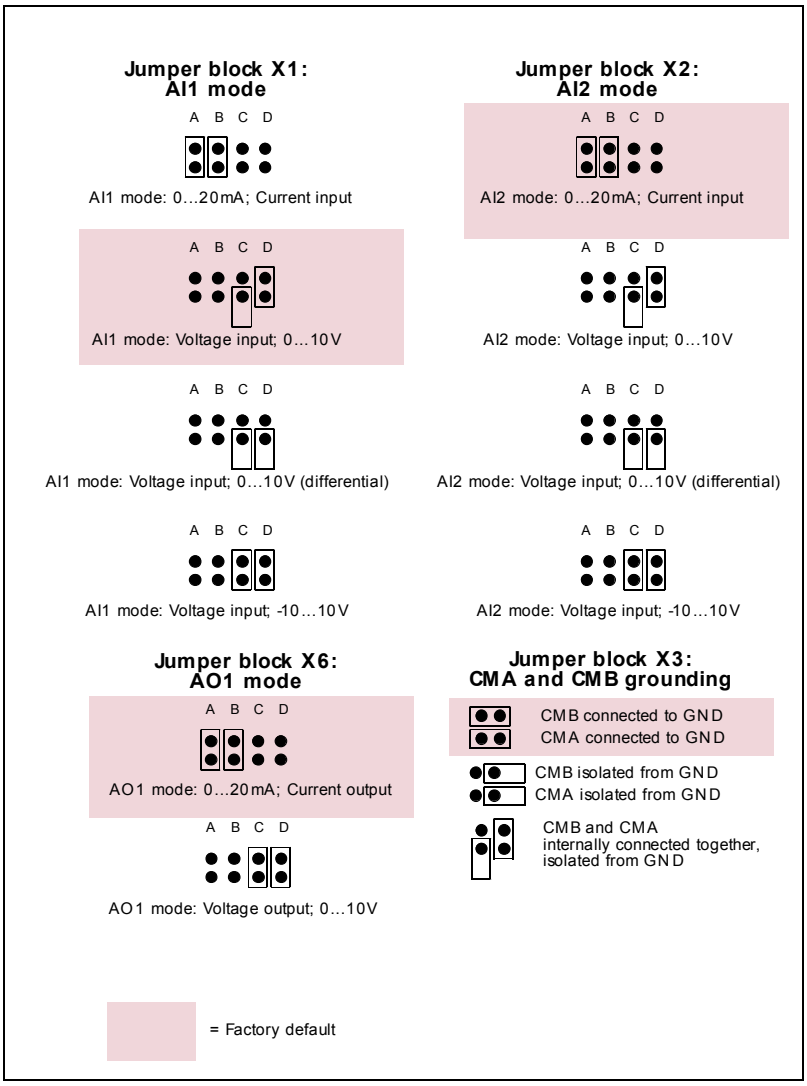
Jumper selections

There are four jumper blocks on the OPTA1 board. The factory defaults and other available jumper selections are presented below.

Figure 23.Jumper block selection on OPTA1



OPTA1 parameters

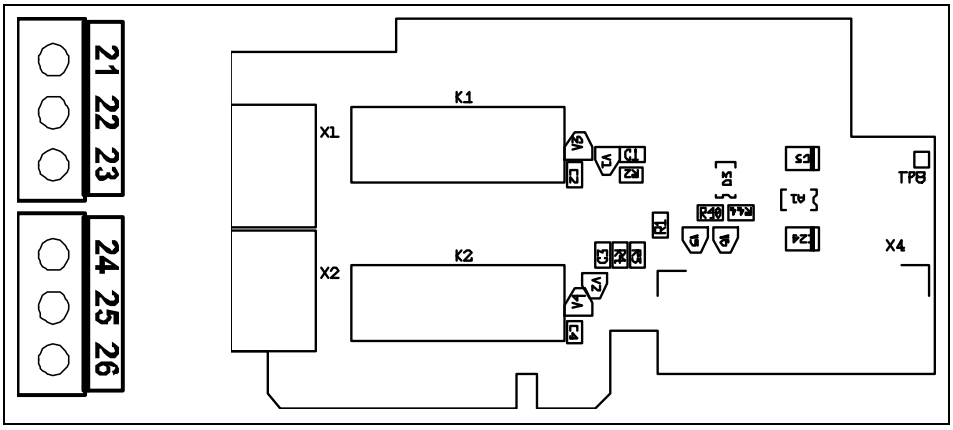
Number	Parameter	Min	Max	Default	Note
1	AI1 mode	1	5	3	**1** = 0...20mA **2** = 4...20mA **3** = 0...10V **4** = 2...10V **5** = -10...+10V
2	AI2 mode	1	5	1	**1** = 0...20mA **2** = 4...20mA **3** = 0...10V **4** = 2...10V **5** = -10...+10V

Table 14. OPTA1 board-related parameters

Number	Parameter	Min	Max	Default	Note
3	AO1 mode	1	4	1	**1** = 0...20mA **2** = 4...20mA **3** = 0...10V **4** = 2...10V

Table 14. OPTA1 board-related parameters

5.4.2 OPTION BOARD OPTA2



Description:	Standard Vacon NX frequency converter relay board with two relay outputs
Type ID:	16690
Allowed slots:	B
Terminals:	Two terminal blocks; Screw terminals (M3); No coding
Jumpers:	None
Board parameters:	None

I/O terminals on OPTA2

Terminal		Parameter reference on keypad and NCDrive	Technical information
21 **22** **23**	RO1/normal closed RO1/common RO1/normal open	DigOUT:**B.1**	Relay output 1 (NO/NC) Switching capacity 24VDC/8A 250VAC/8A Min. switching load 125VDC/0.4A 5V/10mA
24 **25** **26**	RO2/normal closed RO2/common RO2/normal open	DigOUT:**B.2**	Relay output 2 (NO/NC) Switching capacity 24VDC/8A 250VAC/8A Min. switching load 125VDC/0.4A 5V/10mA

Table 15. OPTA2 I/O terminals

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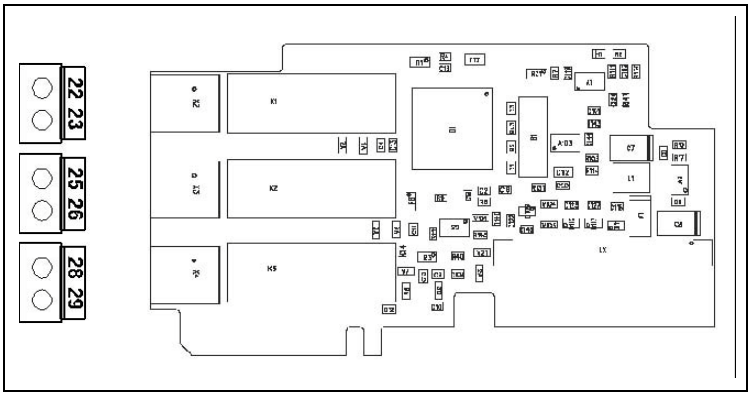
5.4.3 OPTION BOARD OPTB5



Description:	I/O expander board with three relay outputs.
Allowed slots:	B, C, D, E
Type ID:	16949
Terminals:	Three terminal blocks; Screw terminals (M3); No coding
Jumpers:	None
Board parameters:	None

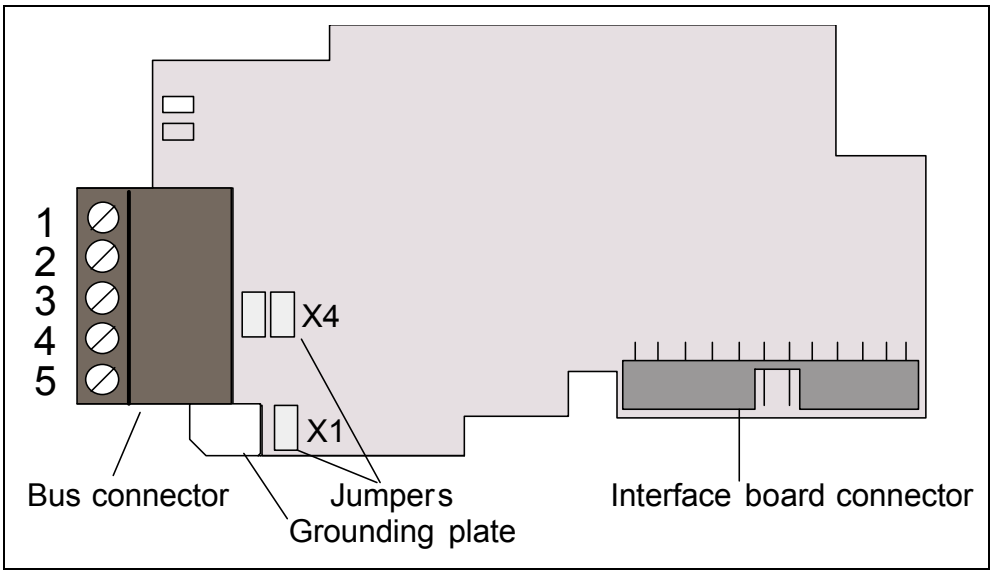
I/O terminals on OPTB5

Terminal		Parameter reference Keypad/NCDrive	Technical information	
22 **23**	RO1/common RO1/normal open	DigOUT: **X.1**	Switching capacity Min. switching load	24VDC/8A 250VAC/8A 125VDC/0.4A 5V/10mA
25 **26**	RO2/common RO2/normal open	DigOUT: **X.2**	Switching capacity Min. switching load	24VDC/8A 250VAC/8A 125VDC/0.4A 5V/10mA
28 **29**	RO3/common RO3/normal open	DigOUT: **X.3**	Switching capacity Min. switching load	24VDC/8A 250VAC/8A 125VDC/0.4A 5V/10mA

Note: This expander board can be placed into four different slots on the control board. Therefore, the 'X' given in the Parameter reference shall be replaced by the slot letter (B, C, D, or E) depending on the slot which the expander board is plugged into.

5.5 OPTION BOARD OPTC2 (RS-485)

Figure 24.Vacon RS-458 option board OPTC2



Signal	Connector	Description
NC*	1*	No connection
VP	2	Supply voltage – plus (5V)
RxD/TxD –N	3	Receive/Transmit data – A
RxD/TxD –P	4	Receive/Transmit data – B
DGND	5	Data ground (reference potential for VP)
*You can use this pin (1) to bypass the cable shield to the next slave		

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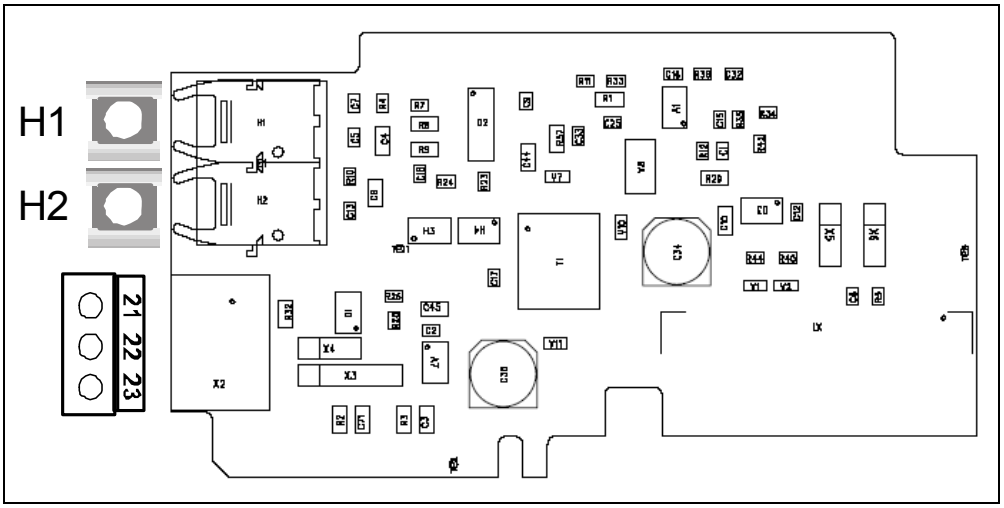
5.6 OPTION BOARD OPTD2



Note! This figure presents the layout of D2 board version H or later. See Chapter Jumper selections below.

Description:	System Bus adapter board with single optical input and output; Interface to fast monitor bus used by the NCDrive PC tool.
Allowed slots:	(B,)D, E; Note: If only the Monitor Bus (terminals 21 to 23) is used the board can also be placed in slot B. The System Bus is then unavailable. Remove therefore jumpers X5 and X6. See page 36.
Type ID:	17458
Terminals:	Single optical input and output; one screw terminal block (M3), Agilent HFBR-1528 (Receiver), HFBR-2528 (Transmitter).
Jumpers:	4; X3, X4, X5 and X6. See page 36
Board parameters:	None

I/O terminals on OPTD2

Terminal		Technical information
1	H1	System Bus optical input 1 (RX1) Use 1-mm optical cable (e.g. Agilent HFBR-RUS500 & HFBR-4531/4532/ 4533 connectors) Note: Not available if the board is placed in slot B
2	H2	System Bus optical output 1/2 (TX1/TX2); Selected with jumper X5 Use 1-mm optical cable (e.g. Agilent HFBR-RUS500 & HFBR-4531/4532/4533 connectors) Note: Not available if the board is placed in slot B
21	CAN_L	Monitor Bus negative data
22	CAN_H	Monitor Bus positive data
23	CAN_SHIELD	Monitor Bus shield

Jumper selections

There are four jumper blocks on the OPTD2 board. The factory defaults and other available jumper selections are presented below.

Figure 25.Jumper selections for OPT-D2, up to version G

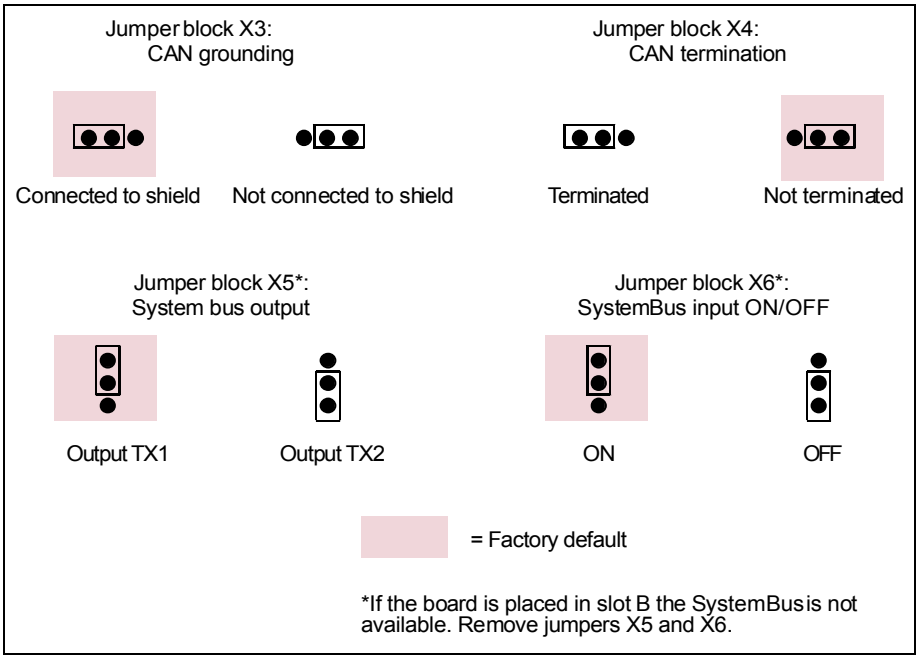
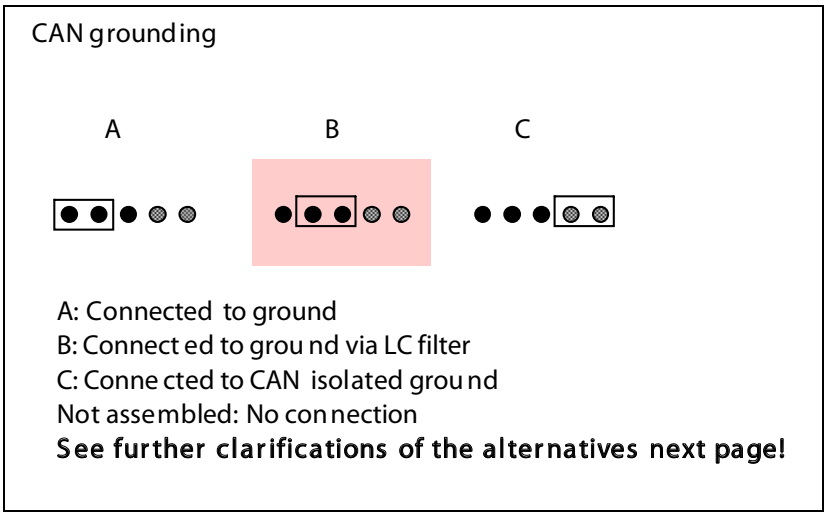


Figure 26.X3 jumper selections for OPT-D2, version H and later



Note! Position C can be used with 3- or 4-wire CAN cable to interconnect isolated CAN ground levels in the network. It is recommended to connect the cable shield to the grounding clamp of the drive.

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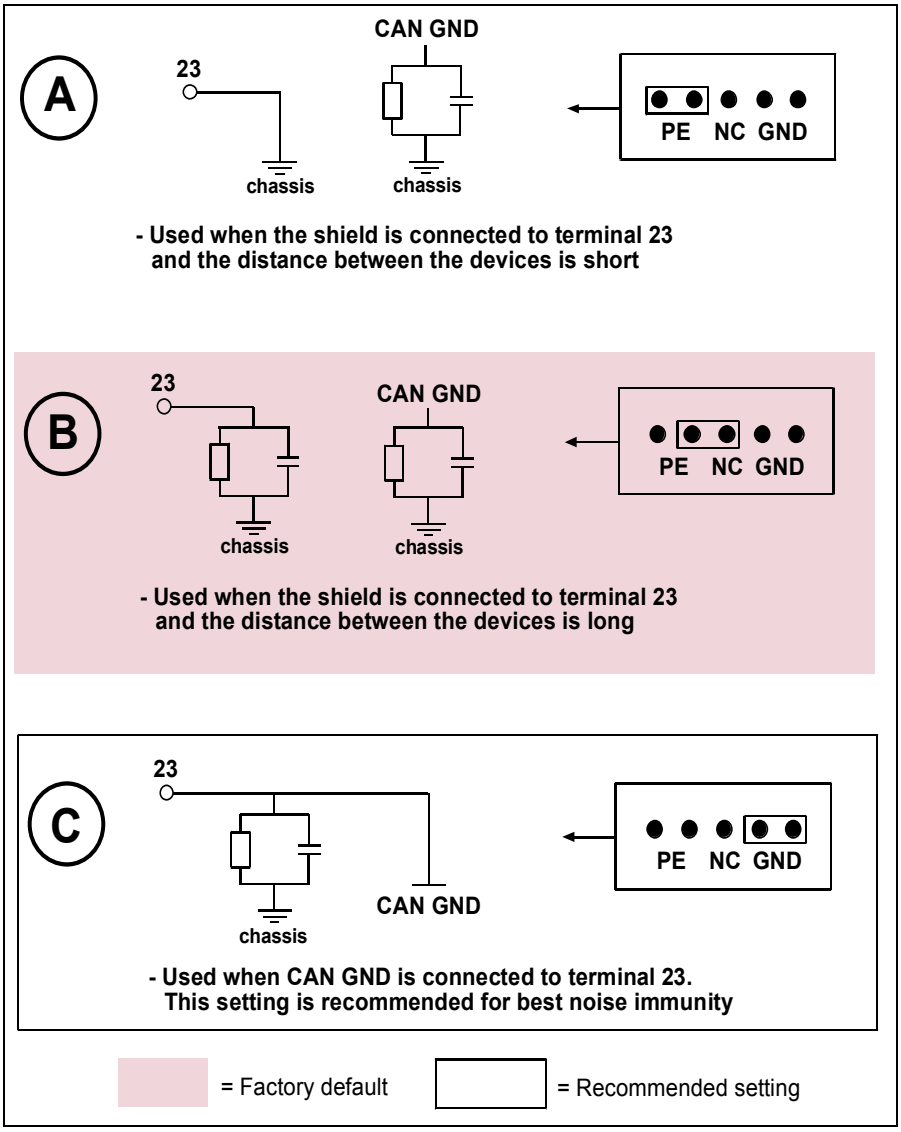
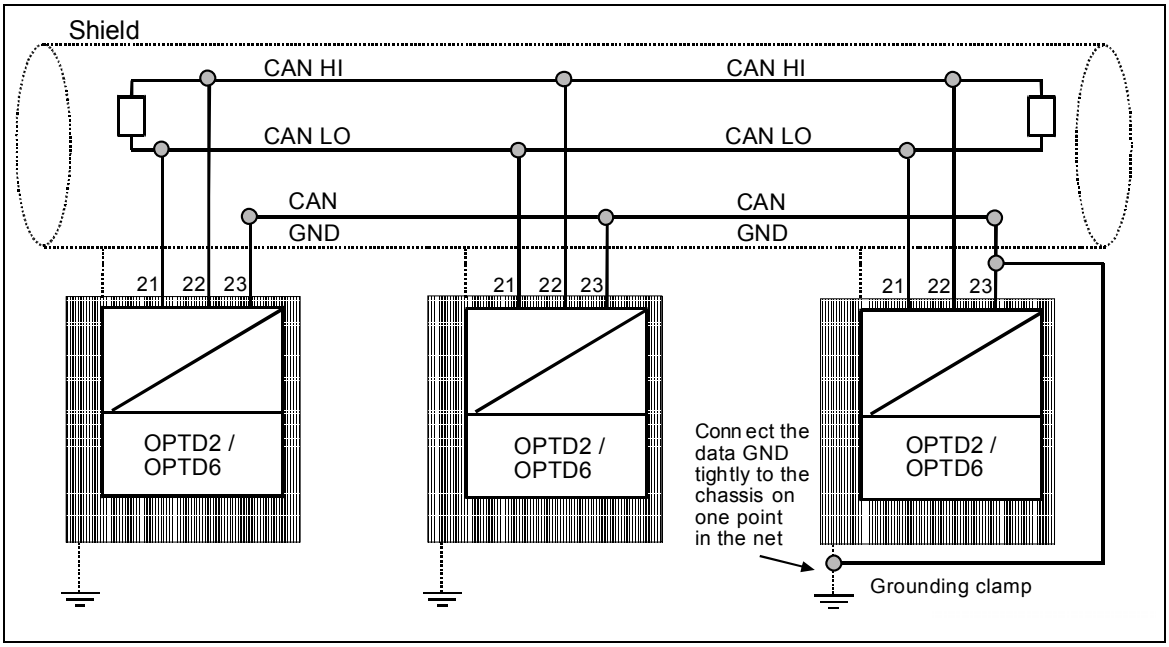
Figure 27.CAN grounding alternatives



Alternative connection of "CAN GND" signal: connect 'CAN GND' together between all nodes. Use the signal wire inside the shield for this purpose, see figure below:

Figure 28.Alternative connection of "CAN GND" signal



Connections between drives with OPTD2

Special connection:

In this connection example, the leftmost device is the Master and the others are slaves. The Master can send and receive data from the slaves. The slaves cannot communicate with each other. Changing of masters is not possible, the first device is always the Master.
The OPTD2 board in the Master has the default jumper selections, i.e. X6:1-2, X5:1-2. The jumper positions have to be changed for the slaves: X6: 1-2, **X5:2-3.**

Max. number of devices in line	Max. speed achieved [Mbit/s]
3	12
6	6
12	3
24	1.5

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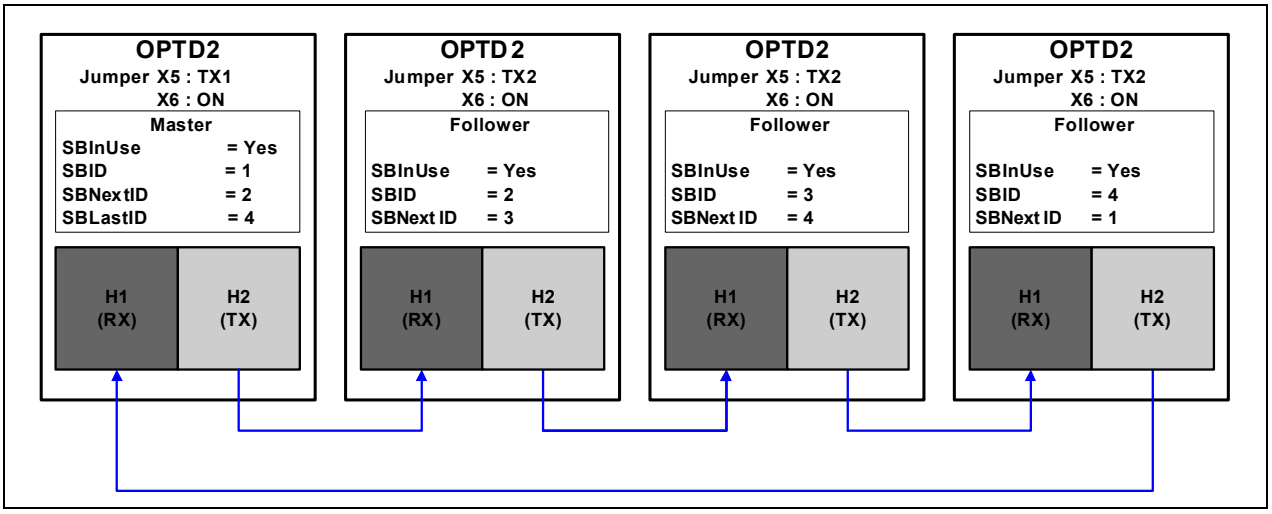
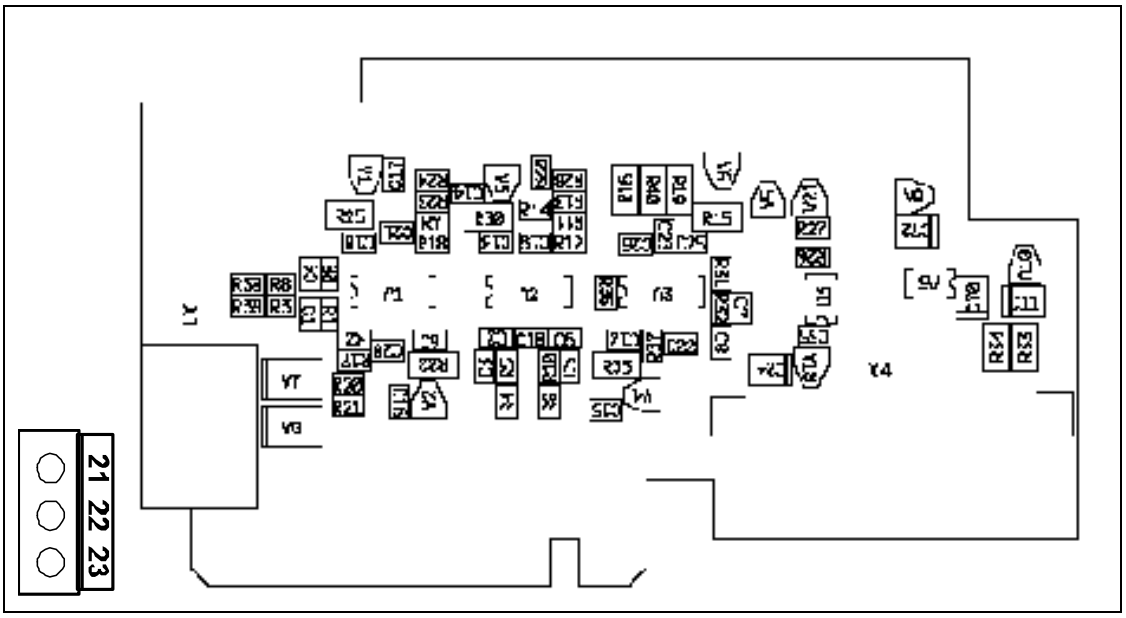
Figure 29.Connection example of drives with OPTD2



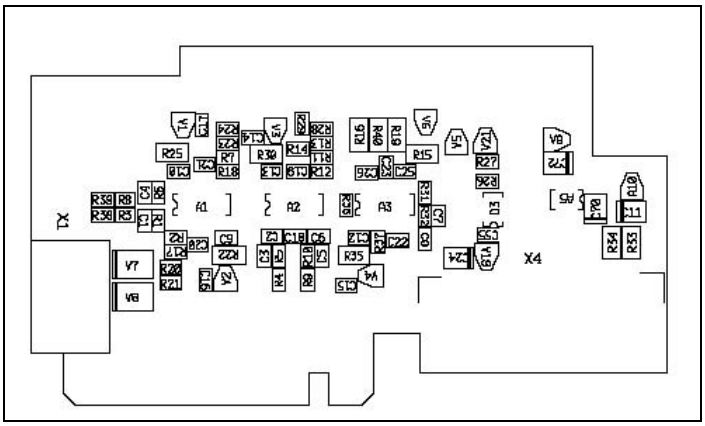
5.7 OPTION BOARD OPTD7 (LINE VOLTAGE MEASUREMENT BOARD)



OPTD7 is an AC sinusoidal voltage measurement board. Using this board, the drive measures the line voltage, frequency and voltage angle information. The drive can compare this information with its output voltage angle when running. This feature can be used to develop applications for different
purposes using NC61131-3 application programming tool.
The OPTD7 board is delivered with the transformer which is suitable for voltage range 380V ...690V. Please note that the transformer can not be used with the pulse width modulated (PWM) voltage input.
It is possible to use custom built transformer when the input voltage to be measured is not within the above voltage range. The transformation ratio parameter then can be adjusted as per the transformer
primary to secondary ratio. Please refer to specification section for further engineering.
The measurement signal connected into the OPT-D7 option board can not exceed 14.26 Vrms.

The board can only be placed in slot C.

OPTD7 connections



OPTD7 board specification

Transformer primary/ input voltage range	Min 380VAC -15% Max 690VAC +15%	
Transformer ratio Primary : secondary	60:1	
Transformer secondary/ output voltage range	14V rms	Between the terminals L1/L2/L3.
Input impedence	L1/L2 =50kOhm L1/L3 = 25kOhm L2/L3 = 25kOhm	L3 is internal virtual common
Cable recommendation	Max 1.5 mm_2, shielded	From transformer output to OPTD7
Measurement resolution	10 bit	
Voltage measurement Accuracy	0.2%	

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5.8 OPTION BOARD OPTCI (MODBUS/TCP BOARD)

Vacon NX frequency converters can be connected to Ethernet using an Ethernet fieldbus board OPTCI.
The OPTCI can be installed in the card slots D or E

Figure 30.OPTCI option board

General	Board name	OPTCI
Ethernet connections	Interface	RJ-45 connector
Communications	Transfer cable	Shielded CAT5e
	Speed	10 / 100 Mb
	Duplex	half / full
	Default IP-address	192.168.0.10
Protocols	Modbus / TCP	
Environment	Ambient operating temperature	–10°C...50°C
	Storing temperature	–40°C...70°C
	Humidity	<95%, no condensation allowed
	Altitude	Max. 1000 m
	Vibration	0.5 G at 9...200 Hz
Safety		Fulfils EN50178 standard

6. START UP

Starting up the VACON 8000 SOLAR inverter is simple, but it is important that the following instructions are followed:

1. Check that the cables from the solar panels are correctly connected and that the DC connection switch is closed.
2. Ensure that the cables coming from the mains supply, including the earth cable, are correctly connected. Check that the main AC-circuit breaker and possible auxiliary circuit breakers are connected and closed.
3. Press the START button on the control panel.

Once these steps have been followed, the inverter will automatically start when the voltage of solar panels exceeds the minimum wake-up voltage, 340 V DC, provided that there is mains voltage. The inverter starts up every day in the morning and automatically stops at night. Due to different atmospheric conditions, the inverter may start up and stop more than once each day.

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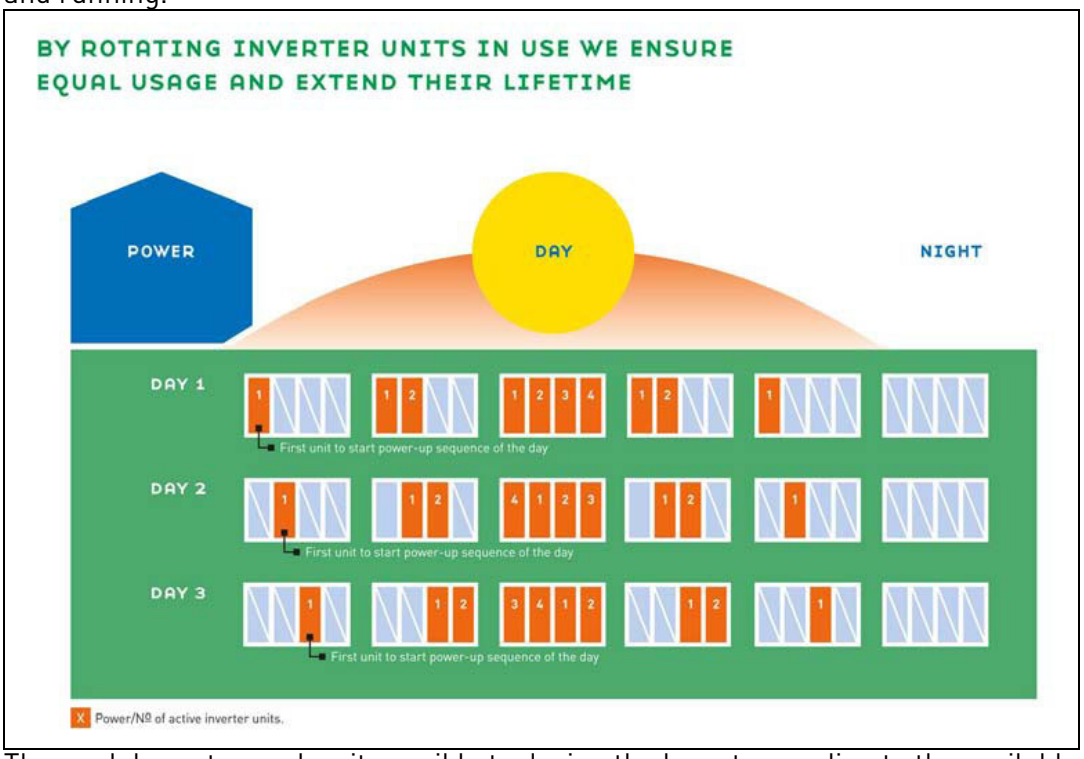
7. THE SOLAR MULTIMASTER APPLICATION

The Solar Multimaster is a unique concept that improves efficiency, reliability and functionality in all large-scale applications.
The concept allows a series of two to five separate inverter units to be connected together in sequence. This means that only the optimal needed number of inverter modules is powered up for minimal power loss. By rotating the inverters in use we can ensure equal usage, thereby extending the entire setup's overall lifetime. The entire setup is centrally controlled via the touch screen on the control unit. This modular approach creates numerous advantages compared to conventional single inverter setups. In addition to allowing for optimisation according to sunlight, the modularity allows for repairs and maintenance to be carried out without complete shutdowns. The charging fuse disconnectors allow single units to be safely connected and disconnected while the setup is up and running.

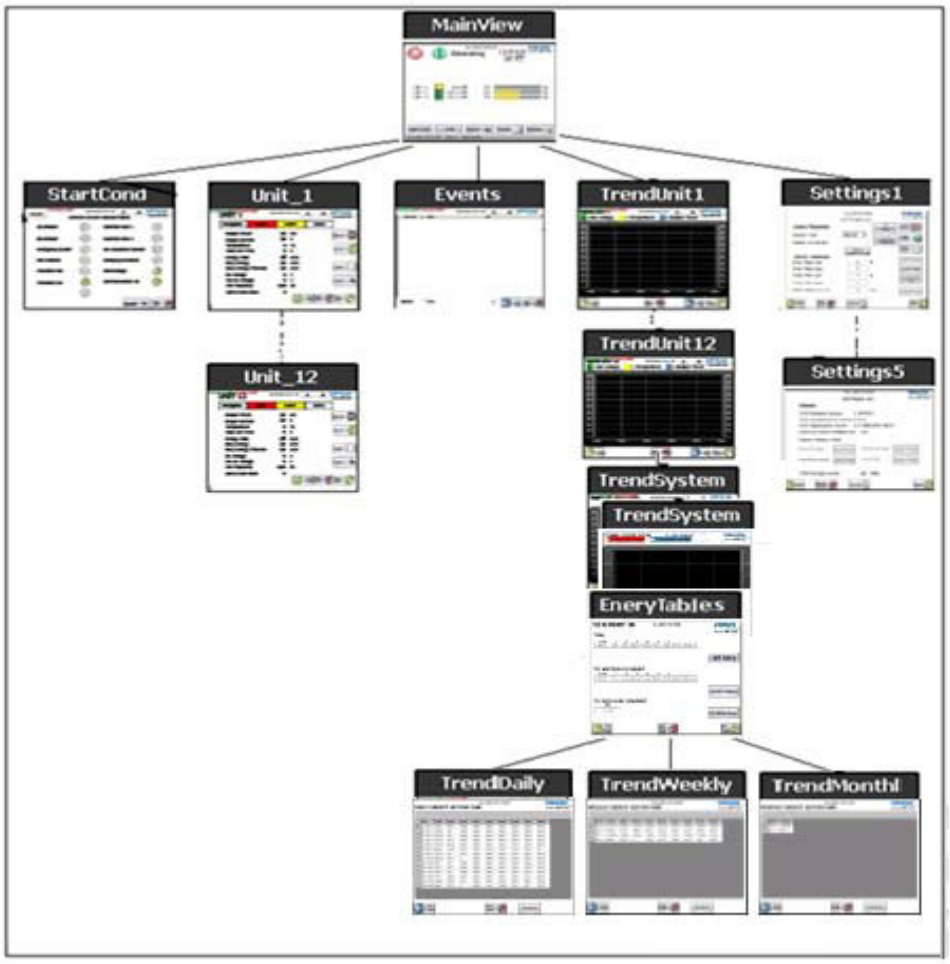


The modular setup makes it possible to design the layout according to the available space, and means that the entire solution is extremely flexible. As a system integrator you can have a buffer stock of single modules and configure the right power level by paralleling the modules and selecting the right power setup using the touch screen. The setup allows you to have fast deliveries when needed.
The Solar Multimaster solution also makes expansion extremely easy. Instead of replacing the entire inverter, you can simply add inverter units onto the setup. Depending on your needs, the set-up can include 1 to 5 individual units. The setup within the individual units is also modular and uncluttered. This means that access to single components, such as the inverter module and LCL-filter, is also easy and fast.

8. CONTROL INTERFACES

8.1 Screens and Navigation

TA70 is a touch screen panel. Operations and navigations of the panel are done by touching the screen.



Transitions to sub-screens is made by touching one of the buttons at bottom of main view.

Figure 31.Buttons to sccess sub-screens

Every sub-screen has a Main View –button that returns to the main view

Figure 32.Home button returns to main view

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8.2 MAIN VIEW

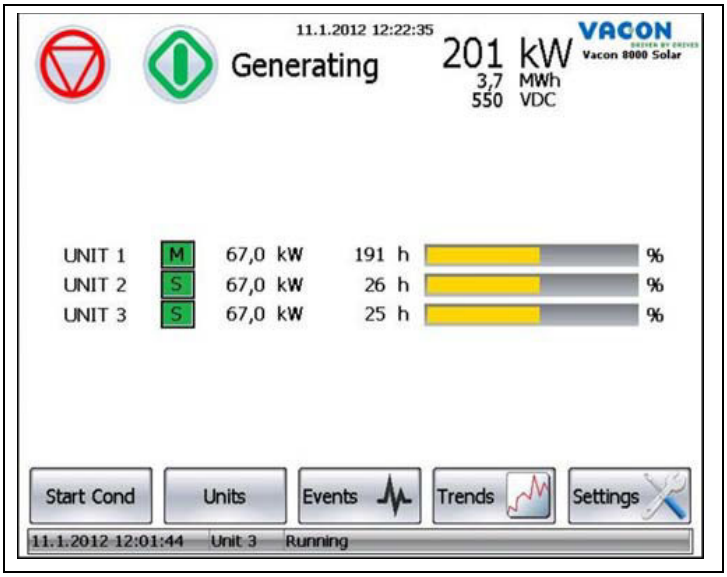
Main view presents all the essential information of the Vacon 8000 Solar system. For more specific information of individual units and historical data there are several sub- screens. System activation and stop buttons are located in main view.

Master is a device that is "The Boss" of the communication. The purpose of the Master is to measure a Grid status, DC voltage and by the DC Voltage it counts a reference value of the DC. By the Grid status master works with Grid standards. Master sends values to slaves and TA70 touch panel. The TA70 touch panel is response to these values and commands the slave units to ON or OFF states, if there is any. Usually in a device combination there are more than one similar devices connected to each other. In these cases one of the devices must be set to be as master and the rest as slave.

Slave is a device that is a "listener" of the communication. The purpose of the Slave is to listen values and commands coming from the Master device.

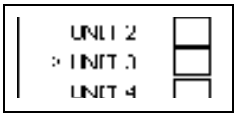
All units are send status information to the TA70 touch panel.

Figure 33.Main view present all the essential information of system



When the system is stopped there is an arrow indicating which unit will start as a master next time.

Figure 34.Indicator showing the next master inverter



8.2.1 SYSTEM ACTIVATION

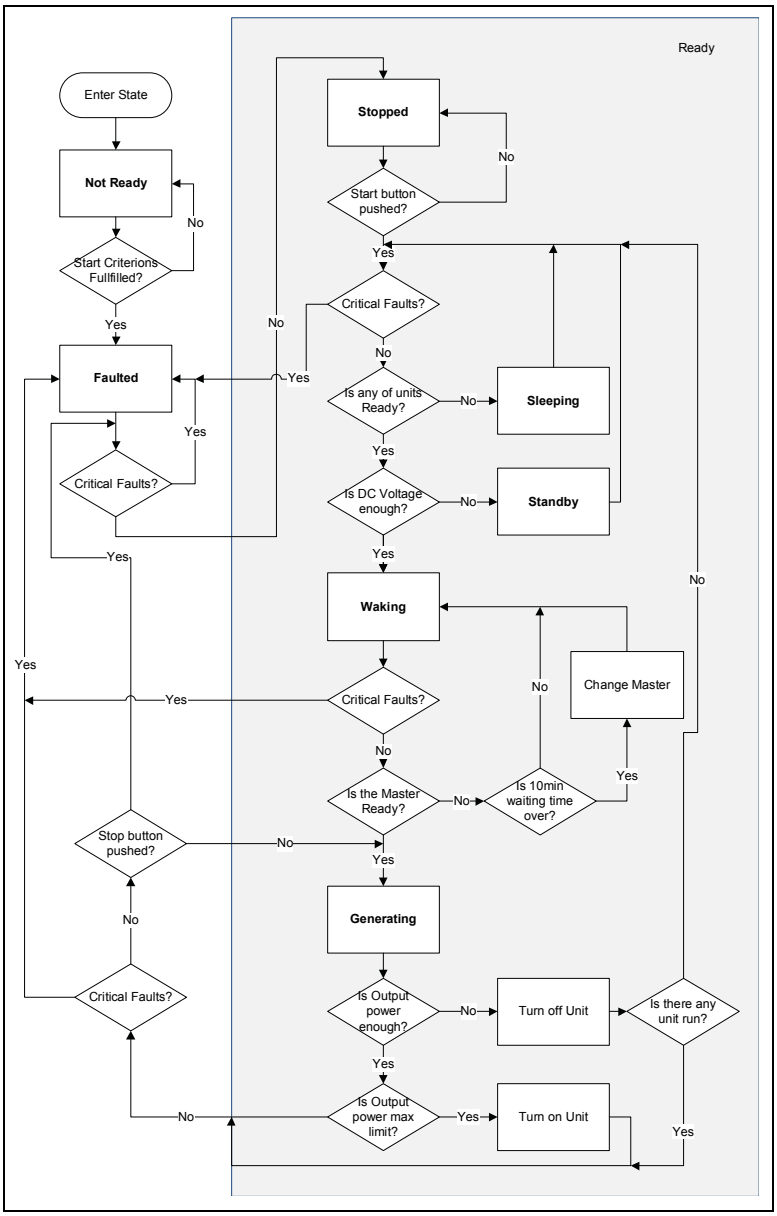
System activation and stop –buttons are placed on top left corner of main view. Buttons also indicates the actual state of system activation. The system remembers the activation state during power downs. See Table 1. Activation/Stop.

Figure 35.System Activation/Stopped status

	System stopped
	System activated

If system is activated, it will not necessary mean that the system starts. It could e.g. be that the inverters are not ready to be started because of low irradiation. However, the system goes into a mode where it either tries to start or waits for the inverters to get ready.

8.2.2 SYSTEM STATUS



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Systems actual status is shown as text in the top of the main view. For different status of system please refer Table 2 System statuses

Table 16. System statuses

Faulted	System is stopped because of a critical fault. Critical faults are explained in chapter 2.3 Start Cond
Not ready	System is stopped due to missing external run enable signal. (For programming of external signals see 2.7.3 Settings 3)
Stopped	System is in stop mode
Sleeping	System is sleeping. There are no unit available. System stays in sleeping state until there are units in ready mode
Waking	There are ready units but the system waits for the master to go to ready state. (The system will change master automatically if not in ready state within 10min {default}.)
Generating	System is running and generating power.
Standby	System is in standby mode.

8.2.3 TOTAL POWER

When system is generating the total power of all units is shown in top right corner of the main view.

Table 17. Total power, Total energy counter and DC bus voltage

8.2.4 TOTAL ENERGY COUNTER

The total energy counter is shown below total power. It is the total accumulated energy produced by all inverter units.

8.2.5 DC BUS VOLTAGE

The DC voltage is shown below total energy counter.

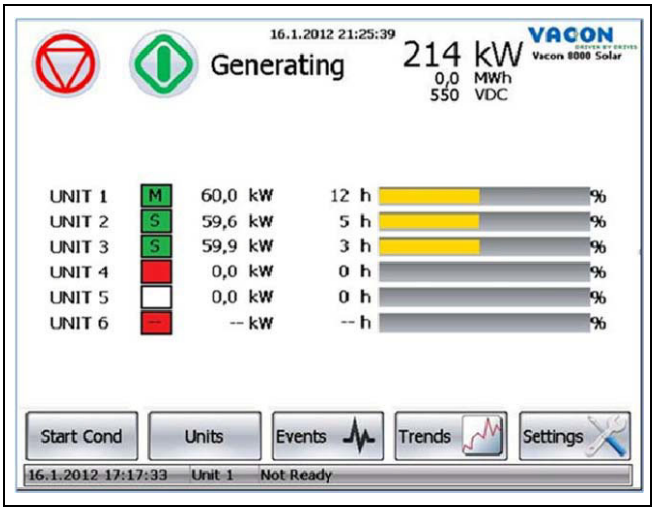
Caution: If all the units are unavailable, e.g. during night time, the value of voltage is blinking red "--". That means the actual DC Voltage is unknown but the DC link might actually have hazardous voltage.

Figure 36.Blinking red "--" indicates no valid DC bus voltage read

8.2.6 Main View Units

Unit status, power generated and total running hour are shown in main view for each unit. Number of unit rows is depending on size of the Vacon 8000 Solar system.

Figure 37.Unit status, power and total running hours are shown for all units



The unit row shows the status of the unit as symbol animation. Indication is explained in Table 8-2.

The power generated in kW is shown as number and bar graph animation in percentage. Running hours is a total counter.

Figure 38.Unit status indication

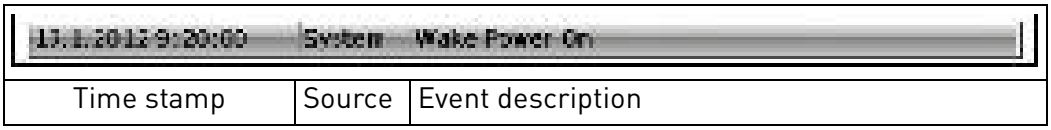
	Unit is ready
M	Unit is runnig as master
S	Unit is running as slave
	Unit is not ready
	DBlinking red: Unit is faulted
M	Master in standby
-	Unit is unavailable

Value "- -" indicates that unit is unavailable or communication not working and actual value or status is unknown.

8.2.7 Event Banner

Last occurred event, alarm or fault is shown in the bottom of the main view.

Figure 39.Last occured event in main view



Time stamp	Source	Event description

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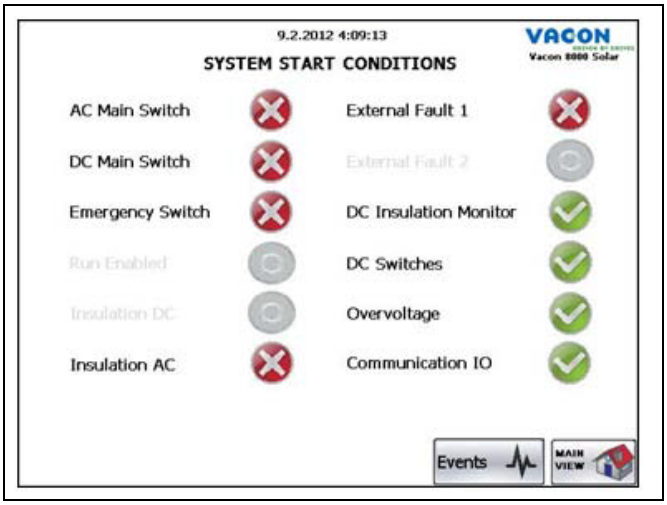
8.2.8 START COND

System start conditions screen summarizes critical faults and states. These faults or states will stop and/or prevents system to start.

Figure 40.System start conditions



Symbols explained below:

Figure 41.Conditions

	Fault or Not OK. Stops the system and/or prevents system to start
	Ok
	N/A. This fault is used in system

Table 18. Conditions

Condition	Possible Fault cause
AC Main Switch	AC Main Switch is not closed.
DC Main Switch	DC Main Switch is not closed. All DC charging switches needs to be opened before the DC Main Switch can be closed.
Emergency Switch	Emergency Stop has been activated.
Run Enable	External run enable signal is not activated.
Insulation DC	There is an insulation fault on the DC side coming from digital input signal.
Insulation AC	Signal from external AC insulation measurement indicates insulation fault on AC side.
External Fault 1	External fault signal from digital input.
External Fault 2	External fault signal from digital input.
DC Insulation Monitor	There is an insulation fault on the DC side coming from analog input measurements.

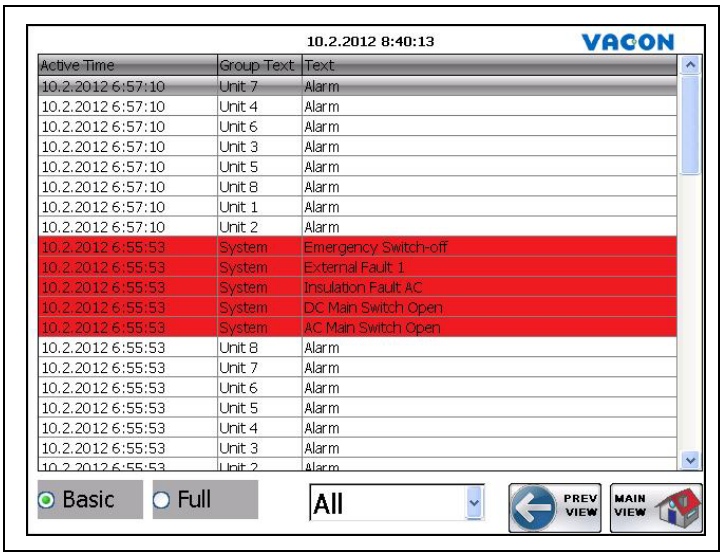
Table 18. Conditions

Condition	Possible Fault cause
DC Swiches	Units DC Switches are not closed although DC Main switch is closed, or they are closed when the DC Main Switch is open.
Overvoltage	One or many inverter(s) have tripped on Overvoltage fault
Communication IO	Communication to Remote I/O module is lost.

8.3 EVENTS

Event list shows faults, alarms and events of system and individual units.

Figure 42.Event list



Each row in list is an event, alarm or fault. Active time is the timestamp when an event has occurred, group indicates the source of event, alarm or fault; it is either system or a specific unit. For events and cleared faults/alarms the background colour of the row is white. For active faults the background colour is red and for active alarms background colour is yellow.

The event list can be filtered to show only faults by choosing the "Basic" radio button. By choosing "Full" the list will show all possible events, faults and alarms of the system and units.

Figure 43.Event list filter options

Basic	Event list is filtered. Only faults of system and units are shown. Green dot indicates the selection
Full	Event list shows all the faults, alarms and events

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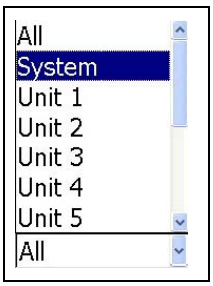
There is also the possibility to filter the list by only showing the events of a specific unit or system events by selection in the drop down list.

Figure 44.Event list can be filtered also by group. Group is either system or an unit



8.4 System Trends

Historical trend of the system are total counters for procured energy and DC insulation measurement.

8.4.1 System Total

System total trend shows the historical value for the total current and total produced power of the system in a time span of last 24 hours. Red trend is the current and blue is the total power produced. Scale of the Y-axis is can be optimized for Output Current or Output Power by the buttons in the top of the screen.

Figure 45.System total current and power monitoring

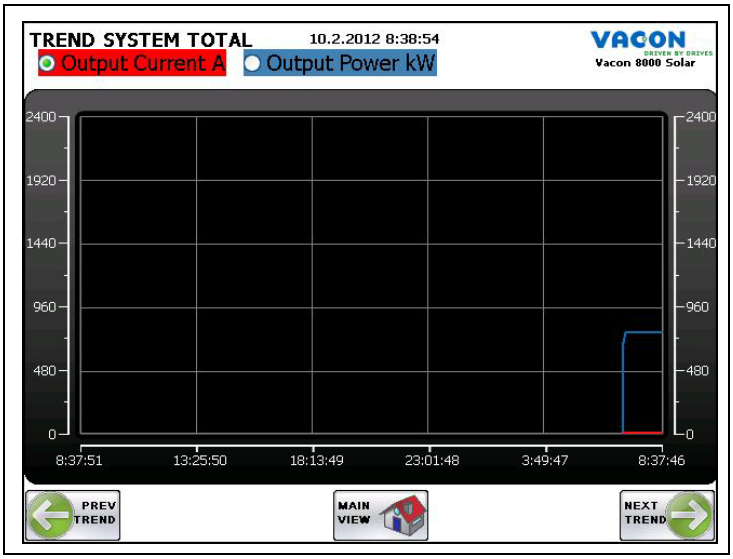


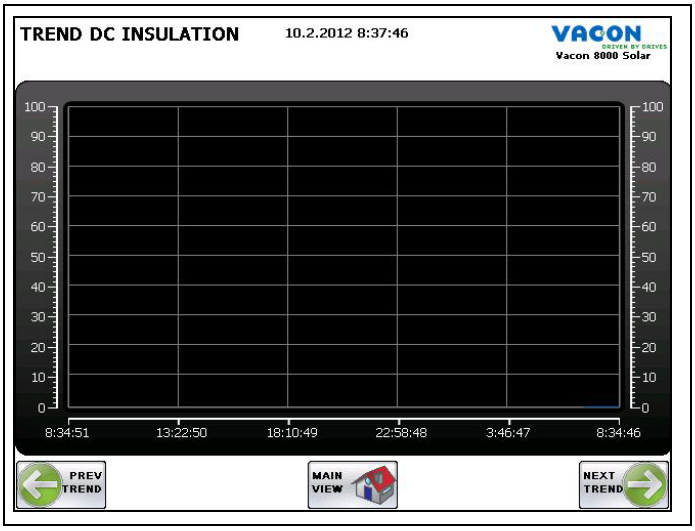
Figure 46.Y-axis scale of trends

Output Current	Scale of Y-axel for the trend is the current [A]. Green dot indicates actual selection
Output Power	Scale of Y-axel for the trend is the power [kW]

8.4.2 DC Insulation Monitoring

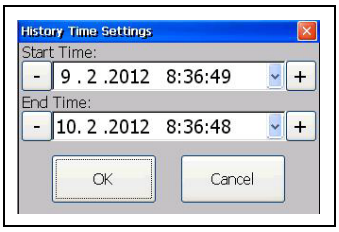
DC insulation trend shows historical measurement of the DC insulation value in scale of 0..100%. This sheet is visible only when DC insulation is measured by analog input.

Figure 47.DC insulation measurement trend



Time span of trend is 24 hours by default. The scale can be changed by touching the trend view and then select another time span.

Figure 48.Time span scaling dialog

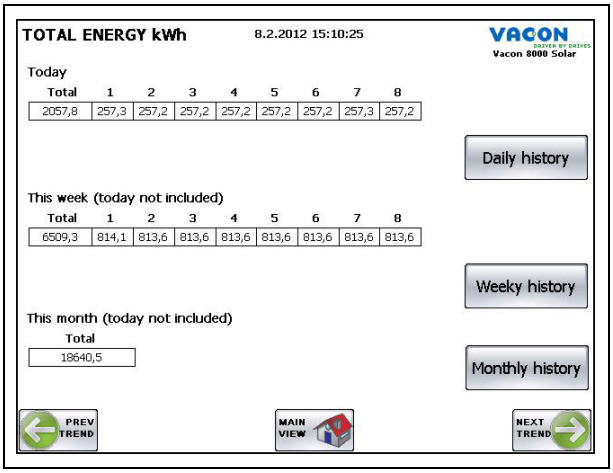


8.4.3 Energy tables

Total Energy kWh page show the total and unit specific energy produced during the present day, week and month.

There are also buttons for accessing historical data on a daily, weekly or monthly basis.

Figure 49.Produced energy table menu page



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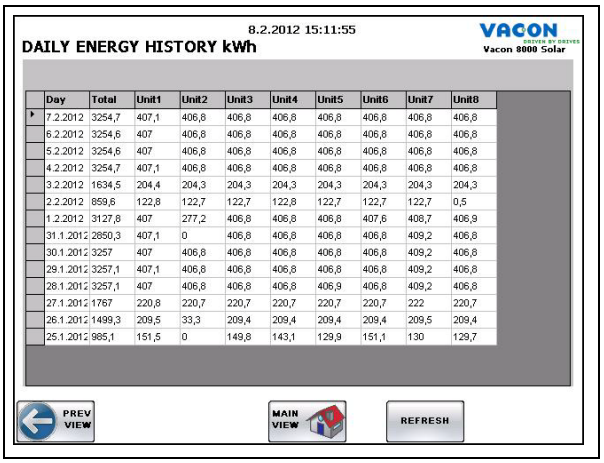
8.4.3.1 Daily energy history

Produced daily energy historical trend summarises the total energy for the system and units produces per day in kWh.

Figure 50. Daily energy produced for whole system and units in kWh

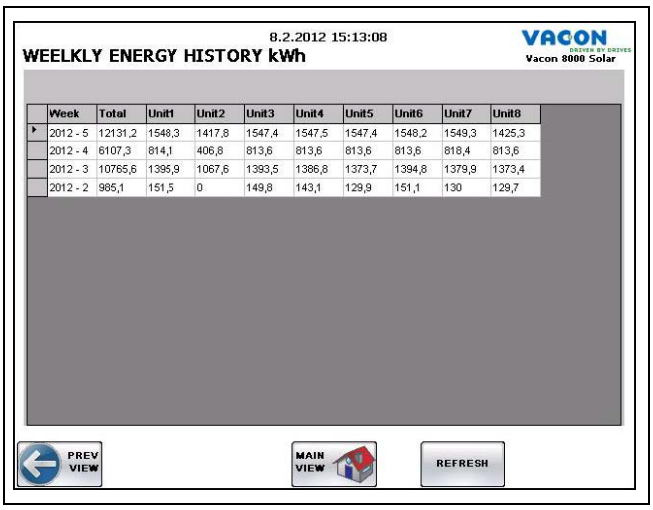


Day	Total	Unit1	Unit2	Unit3	Unit4	Unit5	Unit6	Unit7	Unit8
7.2.2012	3254,7	407,1	406,8	406,8	406,8	406,8	406,8	406,8	406,8
6.2.2012	3254,6	407	406,8	406,8	406,8	406,8	406,8	406,8	406,8
5.2.2012	3254,6	407	406,8	406,8	406,8	406,8	406,8	406,8	406,8
4.2.2012	3254,7	407,1	406,8	406,8	406,8	406,8	406,8	406,8	406,8
3.2.2012	1634,5	204,4	204,3	204,3	204,3	204,3	204,3	204,3	204,3
2.2.2012	859,6	122,8	122,7	122,7	122,8	122,7	122,7	122,7	0,5
1.2.2012	3127,8	407	277,2	406,8	406,8	406,8	407,6	408,7	406,9
31.1.2012	2850,3	407,1	0	406,8	406,8	406,8	406,8	409,2	406,8
30.1.2012	3257	407	406,8	406,8	406,8	406,8	406,8	409,2	406,8
29.1.2012	3257,1	407,1	406,8	406,8	406,8	406,8	406,8	409,2	406,8
28.1.2012	3257,1	407	406,8	406,8	406,8	406,9	406,8	409,2	406,8
27.1.2012	1767	220,8	220,7	220,7	220,7	220,7	220,7	222	220,7
26.1.2012	1499,3	209,5	33,3	209,4	209,4	209,4	209,4	209,5	209,4
25.1.2012	985,1	151,5	0	149,8	143,1	129,9	151,1	130	129,7

8.4.3.2 Weekly energy history

Produced weekly energy historical trend summarises the total energy for the system and units per week in kWh.

Figure 51. Weekly energy produced for and units in kWh

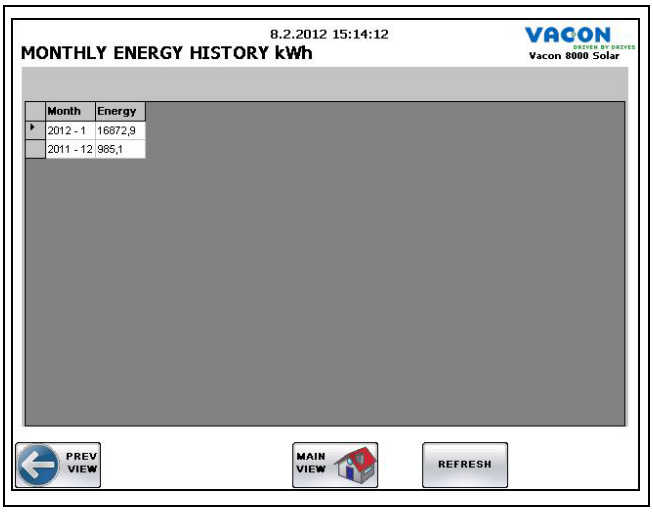


Week	Total	Unit1	Unit2	Unit3	Unit4	Unit5	Unit6	Unit7	Unit8
2012 - 5	12131,2	1548,3	1417,8	1547,4	1547,5	1547,4	1548,2	1549,3	1425,3
2012 - 4	6107,3	814,1	406,8	813,6	813,6	813,6	813,6	818,4	813,6
2012 - 3	10765,6	1395,9	1067,6	1393,5	1386,8	1373,7	1394,8	1379,9	1373,4
2012 - 2	985,1	151,5	0	149,8	143,1	129,9	151,1	130	129,7

8.4.3.3 Monthly energy history

Produced monthly energy historical trend summarises the total energy for the system per month in kWh.

Figure 52.Monthly energy produced for system in kWh

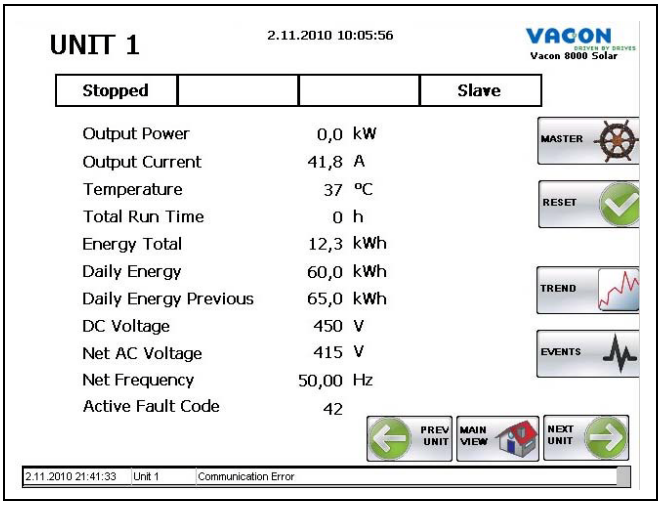


8.5 Unit View

Unit view shows detailed information of the units. There is a screen for every unit defined in the system. Navigation between screens is done by pressing the Prev and Next buttons in the bottom of the screen.

Figure 53.Navigation between units

Figure 54.Unit detailed information



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Unit status, fault, alarm and master/slave state is presented in the status bar on the top of the screen. It has 4 different sections: The general state of the unit, active fault, active alarm or master/slave.

Figure 55. The status bar shows information about the unit

The different general states of the units are listed in table below

Table 19. Unit statuses

Not ready	Unit is not ready. Unit may have been disabled by the stop button on the units keypad or because of low DC Voltage.
Stopped	Unit is stopped
Running	Unit is running and generating power to the grid.
Standby	Unit is in standby mode because of low irradiation.
No Comm,	Unit is unavailable because of no irradiation during night or e.g. loss of communication. All the statuses and values are also showing "- -"

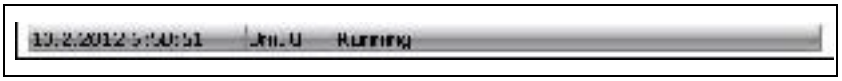
The monitor values are explained in table below.

Table 20. Unit monitor values

Output Power	Output power of the Inverter in kW
Output Current	Output current of the Inverter in A
Temperature	Temperature of the Inverter in °C
Total Run Time	Total run time of the Inverter in hours
Energy Total	Total accumulated amount of energy fed into the grid by the Inverter in kWh
Daily Energy	Todays energy fed into the grid in kWh
Daily Energy Previous	Yesterdays energy fed into the grid the previous day in kWh
DC Voltage	Voltage on the DC bus in VDC
Net AC Voltage	Voltage at the output in V
Net Frequency	Output frequency of the Inverter in Hz
Active Fault Code	Fault code of last active fault

Last occurred event, fault or alarm for unit is shown in the bottom of screen.

Figure 56. Unit event banner



8.5.1 MASTER BUTTON

On right of side lays a Master button. When an unit is running as slave, pressing this button will set the unit to master on the fly. Button is only visible when the unit is running as a slave or system is Stopped. If system is stopped with this button can choose next master.

Figure 57.Master button

8.5.2 RESET BUTTON

Reset button resets faults and alarms on the Inverter unit.

Figure 58.Reset button

8.5.3 UNIT TREND

Unit trend for the DC voltage, unit temperature and output power is shown in a time span of last 24 hours by default. Green trend is the DC Voltage yellow trend is unit temperature and blue trend is produced output power of unit. Scale of Y-axis can be optimized by the buttons in the top of the screen.

Figure 59.Unit trend

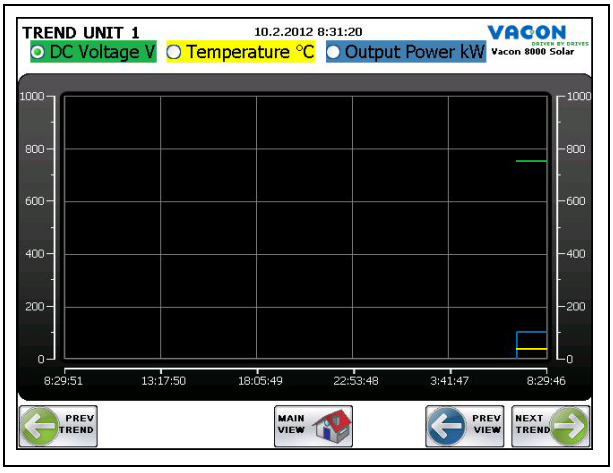
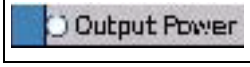


Figure 60.Scale of trends

	Scale of Y-axis for trends is the DC voltage in VDC. Green dot indicates actual selection
	Scale of Y-axis for trends is the unit temperature in °C
	Scale of Y-axis for trends is the output power in kW

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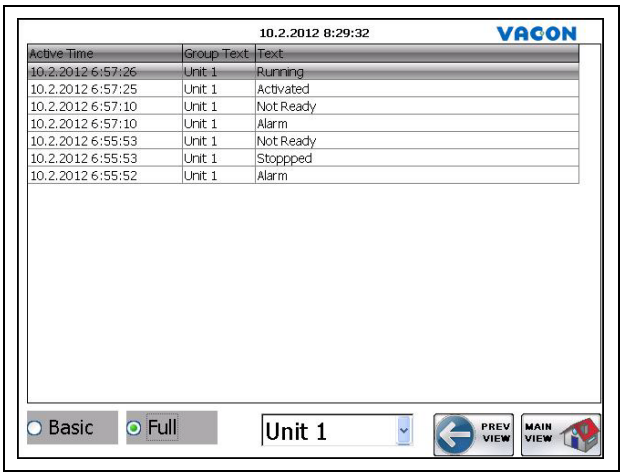
8.5.4 UNIT EVENT

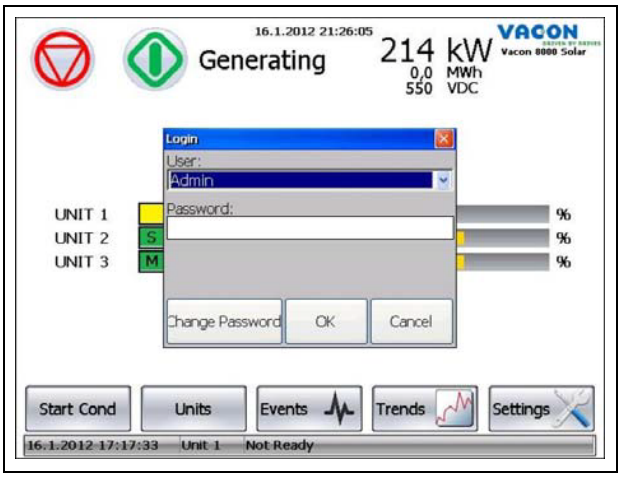
If jumping to the event list from the unit view by pressing the event button. The event list will be set to showing only the events of unit visible in the unit view before jumping to the list. Event list is otherwise the same as in paragraph 0 except for the pre-set filtering of event source. "Prev view" –button returns to unit view.

Figure 61.Unit event list



8.6 SETTINGS

Figure 62.Unit event list



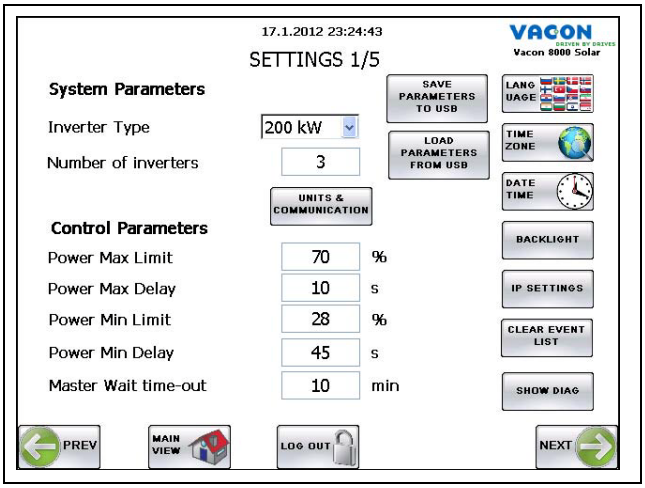
Pressing settings button opens the pop-up login menu. Select User: Admin and touch password field to insert Password. Default Password is: 8000

Access to the settings pages requires a valid password to be entered.

8.6.1 SETTINGS 1

This is the first view accessed when going into the settings. It contains System and control parameters that affects to whole system.

Figure 63.System and control parameters



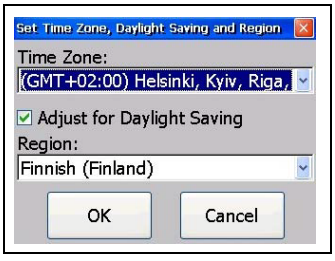
Language:

The language of the operator panel can be set by pressing the language button on the right side.

Figure 64.Language change button

Time zone: Time zone and daylight saving can be configured by pressing the Time Zone button, please refer Picture 31. Region setting affects date and time format and also the decimal symbol of numbers.

Figure 65.Time zone and regional settings



Date/Time: Date and Time of the TA70 can be changed by pressing the Date Time buttons, please refer Picture 32.

Figure 66.Date and time settings

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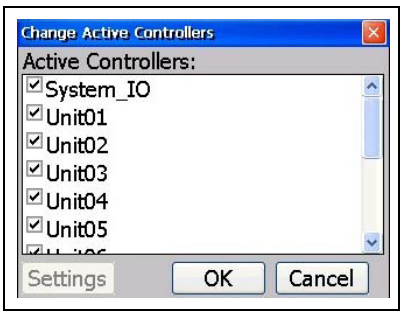
System parameters:

- **Inverter type:** Size of one inverter unit in the MultiMaster setup. Usually 200kW.
- **Number of inverters:** The amount of inverter units in the system. (E.g. a 600kW system consisting of 200kW units should be set to 3.) NOTE! The appropriate amount of active communication controllers for the units has to be activated in the Units & Communications dialog.
- **Unit & Communications:** If the system consist of e.g. 3 inverter units ("Number of Inverter"), then the controllers of Unit01, Unit02 and Unit03 has to be activated. If 5 units then controllers Unit01 through Unit05 and vice versa.

Figure 67.Active controllers are selected according number of inverters



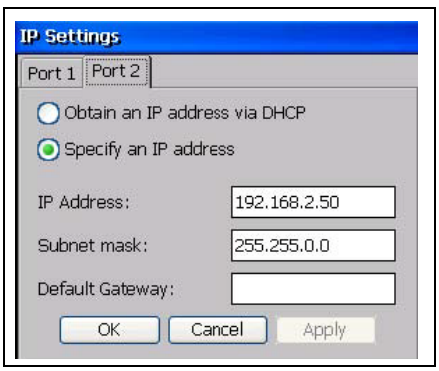
Control parameters

- **Power Max Limit:** If the output power of the master unit exceeds this limit for a time longer than the "Power Max Delay" then a new slave unit is started.
- **Power Max Delay:** If the output power of the master unit exceeds "Power Max Limit" for a time longer than defined with this parameter then a new slave unit is started.
- **Power Min Limit:** Same as for Max but in the opposite direction, units are removed.
- **Power Min Delay:** Same as for Max but in the opposite direction, units are removed.
- **Master Wait time-out:** Wait time for the selected master to get ready if there are other units in ready state. If ready state for the master unit is not entered within this time, the next ready unit is automatically assigned as a new master and system started.

IP Settings

Pressing the IP Settings button gives the possibility to set the Ethernet settings. NOTE! Port 1 is for the internal use MultiMaster system only and should never be changed. Port 2 can be used for connection an external supervisory or SCADA system for monitoring purpose. The IP address of port 2 is not allowed to be in the same range as port 1, hence 192.168.0.X .

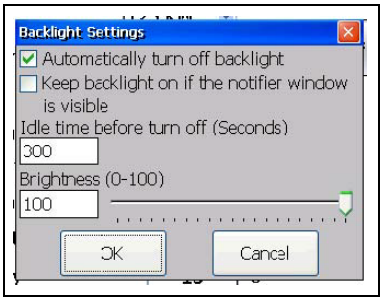
Figure 68.IP Settings pop-up menu



Backlight Settings

Screen brightness and delay for turning the backlight off when the panel is not used can be set here. Note! If the automatic turn off of the backlight is not used, then the life time of the panel will be reduced.

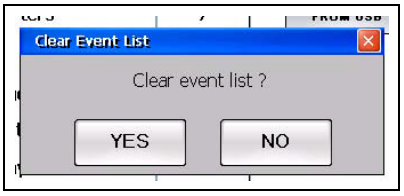
Figure 69. Backlight settings pop-up menu



Clear Event List

Clear event list will erase the historical data in the event list. Confirmation will be asked.

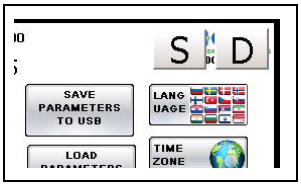
Figure 70. Clear event list pop-up menu



Show Dialog

This is a debug mode to access fieldbus and panel system data(CPU load, etc.).

Figure 71. Show dialog buttons



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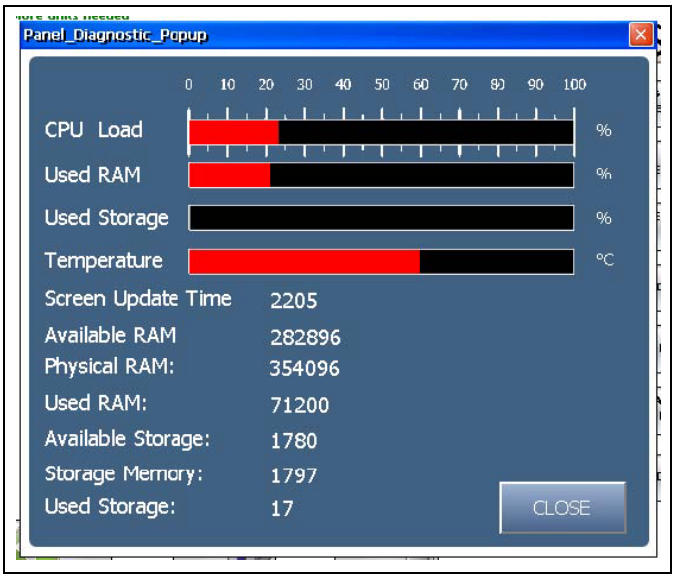
D button gives you access to the Panel diagnostic tool where e.g. CPU Load, Used Memory, Temperature and Screen info can be seen.

Figure 72.Panel diagnostic tool pop-up



S button gives you access to the System diagnostic pop-up screen for internal use and debugging by Vacon service personnel only.

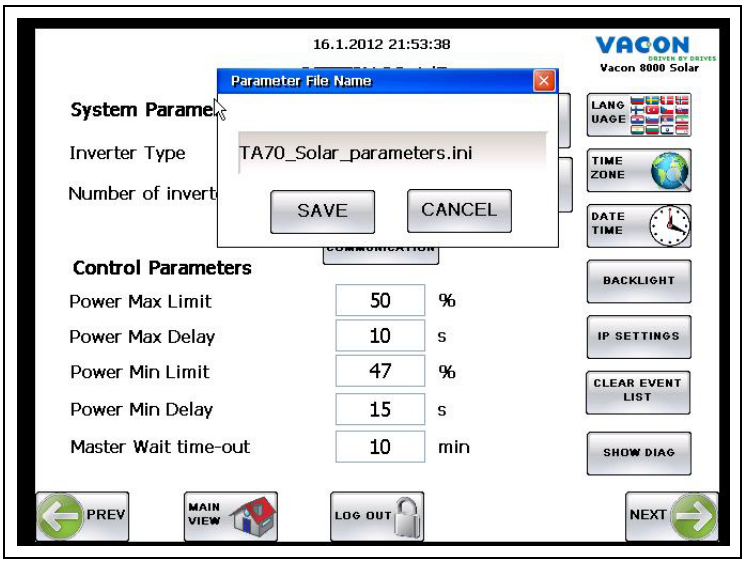
Save Parameters to USB

This function needs an USB memory stick to be connected to the USB port.

Figure 73.Connect to USB memory to touch panel

Pressing Save parameters to USB button will open a pop-up menu for choosing the name of the parameter file to be saved on the USB memory stick. The parameters are saved as an .ini file.

Figure 74.Save parameters to USB pop-up menu

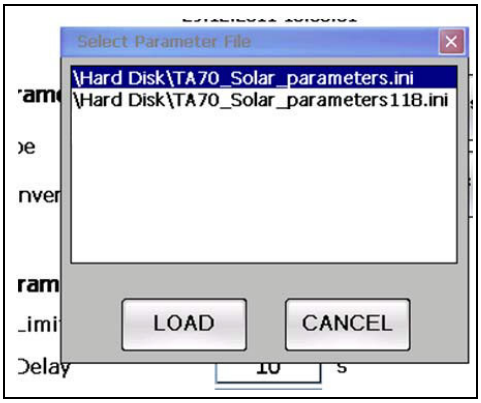


Load Parameters from USB

This function needs an USB memory stick to be connected to the USB port and contain a valid parameter file in .ini format.

Selecting the wanted parameter file and pressing the Load button will override the current setting with the settings of the parameter file.

Figure 75.Load parameters from USB pop-up menu



8.6.2 SETTINGS 2

This view contains the settings for DC Insulations monitoring through analog input and Wake Power control.

DC Insulation Monitor (Only if Analog Input is used for DC Insulation monitoring):

Actual Measurement Live updated value of the DC Insulation level.
DC Insulation Alarm Level DC Insulation measurement warning level.
DC Insulation Fault Level DC Insulation measurement trip level.
Note! By pressing the button on the right of the fault level parameter, one can choose if exceeding the fault level should trip/stop the system or only indicate a fault event in the event list.
DC Insulation Hysteresis DC Insulation measurement hysteresis level for returning from a fault or alarm state..
DC Insulation Delay Time to exceed the fault/alarm level before a fault/alarm occurs.

Wake Power:

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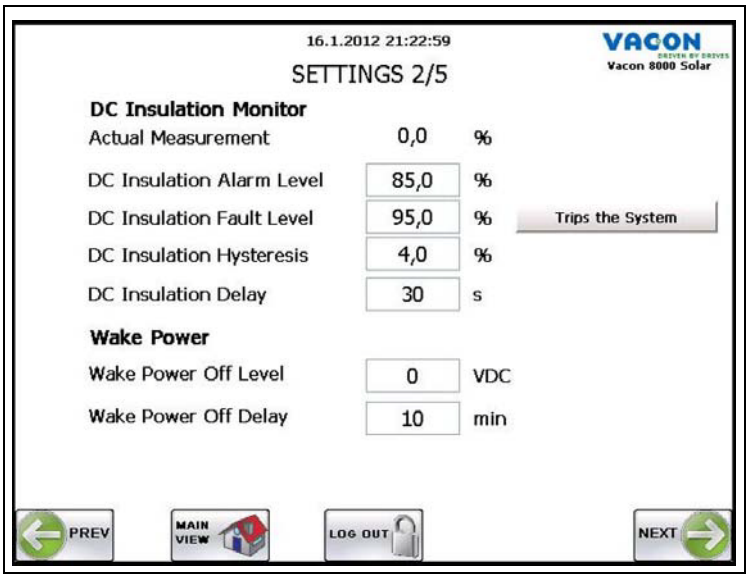
Wake Power is auxiliary power (24VDC) backup to the control boards of every inverter unit.

Wake power is set on when there is communication to any unit and the DC bus and voltage above 220VDC. The Wake Power is removed in the evening when DC voltage reaches Wake Power Off Level for a time longer than Wake Power Off Delay.

Figure 76.Setting for DC insulation monitor



8.6.3 SETTINGS 3

Screen shows definitions of the I/O connections.

Figure 77.System IO functions

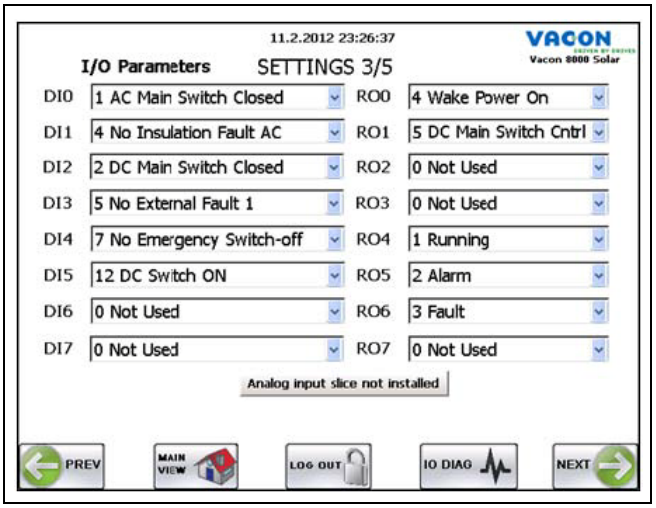


Table 21. Selection of possible input values

Input name	Definition
Not Used	Not Used
AC Main Switch Closed	AC Main Switch feedback input (NO)*
DC Main Switch Closed	DC Main Switch feedback input (NO)*
No Insulation Fault DC	External DC Insulation measuring device Fault input (NC)**
No Insulation Fault AC	External AC Insulation measuring device Fault input (NC)**
No External Fault 1	External Fault Input (NO)*
No External Fault 2	External Fault Input (NO)*

Table 21. Selection of possible input values

Input name	Definition
No Emergency Switch-off	Emergency switch Input (NC)**
Run Enable	External Run Enable input (NO)*
No Surge Arrester Alarm	External surge arrester alarm input. (NO)*
No External Alarm 1	External Alarm Input (NO)*
No External Alarm 2	External Alarm Input (NO)*
DC Switch ON	DC Switch feedback input (NC)**

(* Normally Open contact

(** Normally Close contact

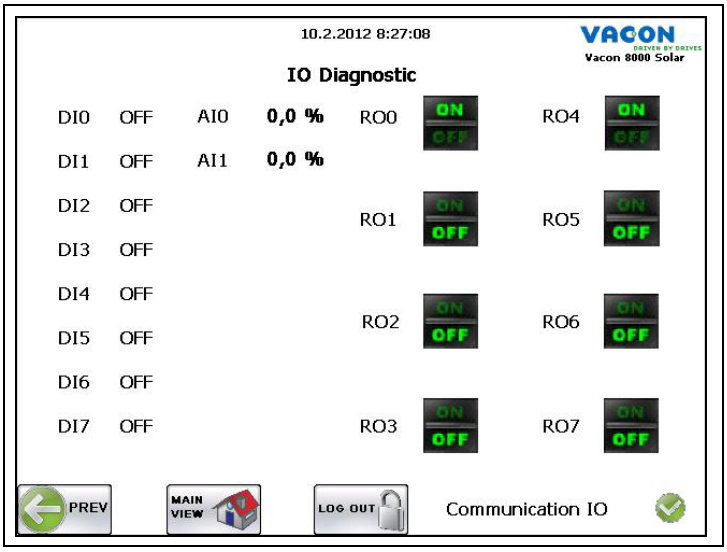
Table 22. Selection of possible Output values

Output name	Definition
Not Used	Not Used
Running	System is Running state
Alarm	System is Alarm state
Fault	System is Fault state
Wake Power On	This is output what wake up the power in the units
DC Main Switch Cntrl	Control DC main switch state.

*8.6.3.1 **IO Diag***

On IO Diagnostic screen show actual status of system IO. Digital and analog inputs shows actual state or value of input. Relay output shows actual state of output. Output status can also be changed via this screen.

Figure 78.Status of system IO



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8.6.4 SETTINGS 4

Settings 4 screen show communication status of system IO and units.

Figure 79.Communication status for system IO and units

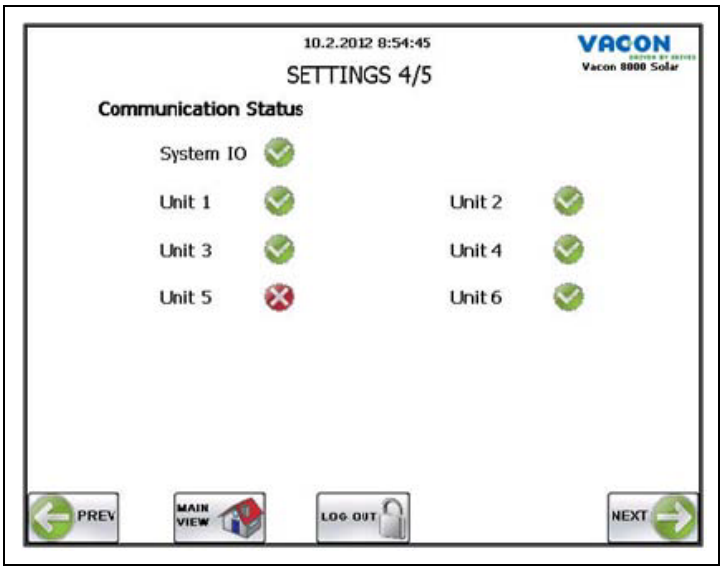


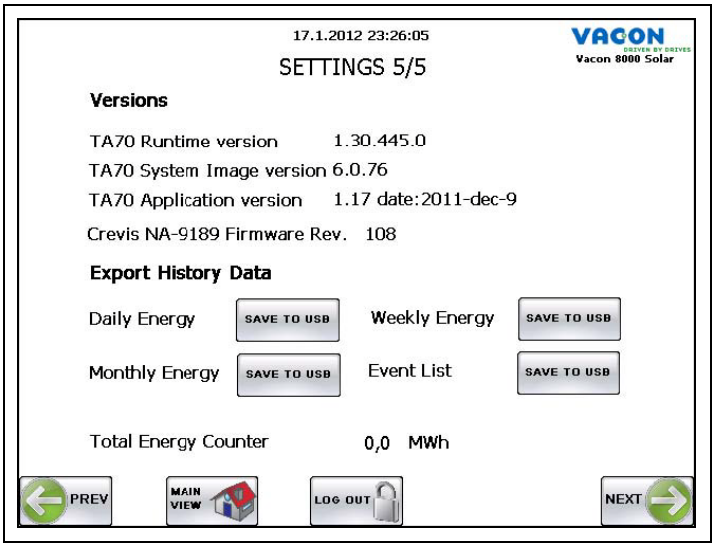
Figure 80.Communication status animation

	Communication OK
	Communication error. System IO or an unit is unavailable

8.6.5 SETTINGS 5

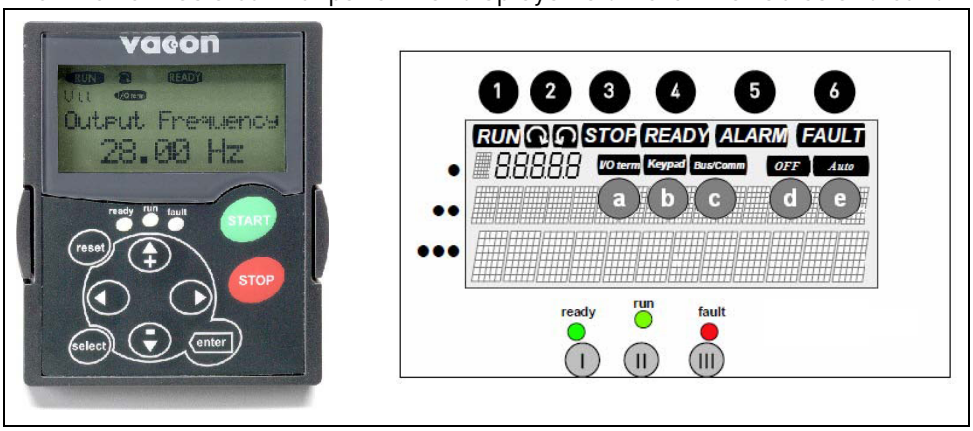
Screen shows TA70 version information as well as system IO version number and Total Energy Counter value. There is also a possibility to save Energy tables and Event list to the USB memory.

Figure 81.Settings 5/5



9. INVERTER CONTROL KEYPAD

The inverter has a control panel that displays its different variables and conditions.



9.1 INDICATORS OF THE INVERTER CONDITION

Inverter state informs the user about conditions of the inverter and whether the control software has detected any operating fault.

1 RUN	= The inverter is running.
2	= Indicates the order of phases in the mains.
3 STOP	= Indicates that the inverter is not running.
4 READY	= Illuminated when DC level is OK. In case of a fault, the symbol will not light up. Also signifies a valid license or trial time.
5 ALARM	= Indicates that the unit is running above a certain limit and issues an alarm.
6 FAULT	= Indicates that there are unsafe running conditions and therefore the unit has stopped.

Control place indications:

a *I/O term*	= I/O terminals are the selected control place; i.e. START/STOP commands or reference values etc. are given through the I/O terminals.
b *Keypad*	= Control keypad is the selected control place; i.e. the Inverter can be started or stopped, or its reference values etc. altered from the keypad.
c *Bus/Comm*	= The inverter is controlled through a fieldbus.
d *OFF*	= Run enable not active
e *Auto*	= Unit is ready to start in the morning.

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9.2 STATE LEDS

State LEDs light up according to state indicators READY, RUN and FAULT of the inverter. If all LEDs blink the drive is uncommissioned.

	= Lights up with DC voltage connected to the converter with no active failure. The state indicator READY also lights up simultaneously.
	= Lights up when the converter is running.
	= Blinks when there are unsafe running conditions and the unit has therefore stopped (fault trip). Simultaneously, the state indicator FAULT blinks in the display and shows a description of the fault; see chapter Active Faults.

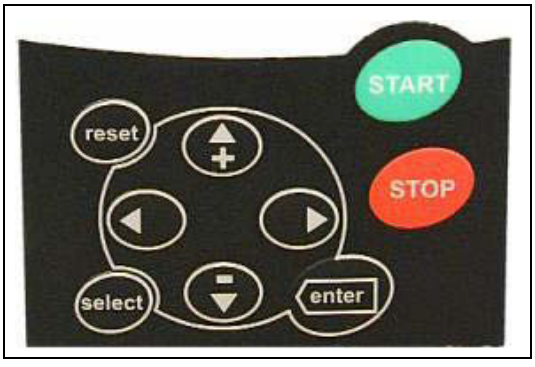
9.3 TEXT LINES

The three text lines (•, ••, •••)provide the user with information about the current location within the menu structure of the panel, separate from information related to the operation of the unit.

•	= Indication of the place in the panel; it shows the menu symbol and number, parameter, etc. Example: M1 = Menu 1 (Display); P1.3 = Generated power
••	= Description line; Shows the description of the menu, value or fault.
•••	= Value line; it shows numeric values and reference texts, parameters, etc, as well as the number of submenus available for each menu.

9.4 PANEL PUSH BUTTONS

The alphanumeric control panel of the inverter VACON 8000 SOLAR has 9 push buttons used to control the inverter and to monitor values.



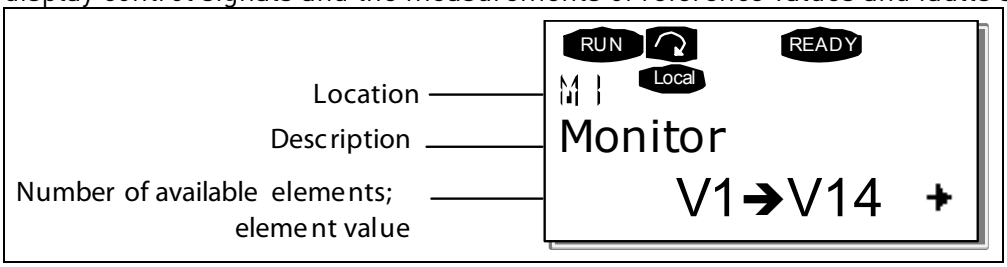
9.4.1 DESCRIPTION OF PUSH BUTTONS

	= This push button is used to reset active faults.
	= This push button is used to switch between the two last displays.

enter	= The Enter push button serves to: Restore the fault history (2-3 seconds)
▲ +	= Push button browser up Browse the main menu and the pages of different submenus.
- ▼	= Push button browser down Browse the main menu and the pages of different submenus.
◄	= Push button Menu left Return to the menu.
►	= Push button Menu right Go forward in the menu.
start	= To start-up the inverter In a Multi-Master system: Enable inverter
stop	= To stop the inverter In a Multi-Master system: Disable inverter

9.5 BROWSING THE CONTROL PANEL

Data on the control panel is arranged in menus and submenus. Menus are used, for example, to display control signals and the measurements of reference values and faults shown.



The first menu level has menus from M1 to M7 and it is called *Main menu*. The user can browse the main menu using the Browse push buttons up and down. The chosen submenu can be accessed from the main menu using the Menu push buttons. When there are pages under the menu or page shown, you will see an arrow ( ) in the bottom right corner of the display and you will be able to access the following menu level by pressing the *Push button Menu right*.

9.5.1 MONITORING MENU

To enter the Monitoring menu from the Main menu, press the Push button Menu right when the location indication **M1** appears in the first line of the screen. The following figure shows how to view the monitored values.

The monitored signals have the indication **V#.#** and are listed in the following table. Values are updated every 0.3 seconds.

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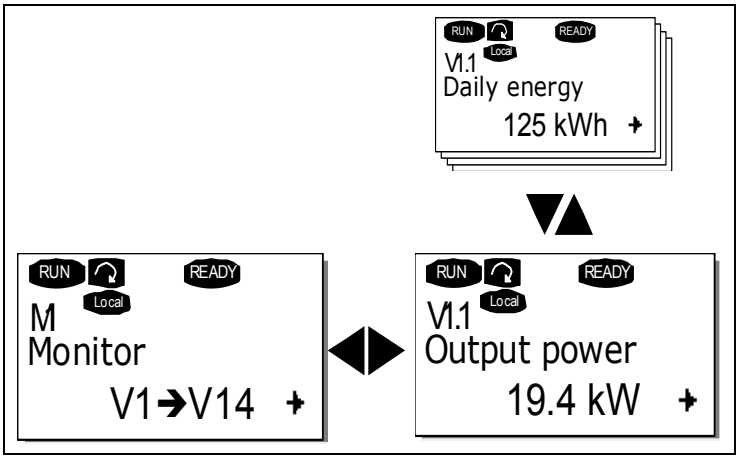
This menu is used only to verify the signals. Values can not be modified.



Code	Parameter	Min	Max	Unit	ID	Description
V1.1	Output power	0	1000	kW	1707	Output power of inverter, with compensated LCL filter losses.
V1.2	Total energy kWh	0	4,29E+09	kWh	1837	Total energy of inverter fed into the grid.
V1.3	Energy today kWh	0	6553,5	kWh	1708	Energy fed into the grid today.
V1.4	Energy yesterday	0	6553,5	kWh	1733	Energy fed into the grid yesterday.
V1.5	DC voltage reference	50	150	%	1200	Used DC voltage reference by the regenerative unit in % of the nominal DC voltage.
V1.6	DC-link voltage	0	1000	V	1839	Filtered DC-link voltage in Volt.
V1.7	Unit temperature	-50	200	°C	1109	Temperature of the unit in Celsius
V1.8	AC voltage	0	1000	V	1709	AC voltage measured on the grid side of the main contactor by an external measurement circuit.
V1.9	AC frequency	-60	60	Hz	1835	Grid frequency in Hz. The sign indicates the phase order. Can be monitored only when UNIT is in RUN state.
V1.10	Output current	0	Varies	A	1834	Output current of the inverter coming out of the cabinet (transformers inside cabinet are taken into consideration).
V1.11	Run time total [h]	0	99999999	h	1836	Total time the inverter has been running.

Table 23. Monitoring values

Code	Parameter	Min	Max	Unit	ID	Description
V1.12	Run time today	0	255	h	1731	The time the inverter has been running today.
V1.13	Run time yesterday	0	255	h	1732	The time the inverter ran yesterday.
V1.14	Grid connections	0	4,29E+09		1706	Total number of times the inverter has closed the main contactor and connected to the grid.
V1.15	Standby remaining	0	65535	s	1201	Remaining time in standby mode, if standby mode is activated.

Table 23. Monitoring values

9.5.2 Active faults menu

The Active faults menu can be reached from *Main menu* pressing the *Menu right push button* when the location indication **M4** can be seen in the first line of the panel display.

When the frequency converter stops due to a fault, the location indication F1, the fault code, a short description of the fault and the symbol of the fault type appear on the display. Besides, the indication FAULT or ALARM will appear and, in case of FAULT, the red LED of the panel will start to blink. If there are several faults simultaneously, the list of active faults may be browsed using the push buttons

in the browser

Fault codes are listed in chapter 7.2.

The memory of active faults can store a maximum of 10 faults in order of occurrence. You can delete the display using the *Reset push button* and the reading device will go back to the same state where you were before the fault trip. The fault is active until it is deleted with the *Reset push button*.

Normal state, no faults	

9.5.3 Fault history menu (M5)

The *Fault history menu* can be accessed from the *Main menu* pressing the *Menu right Push button* when the location indication **M5** is visible on the first line of the panel display.

All faults are stored in the *Fault history* menu,which can be browsed with *Browser Push buttons*.

You can go back to the previous menu at any time, pressing the *Menu left push button* .

The memory can store a maximum of 30 faults in order of appearance. The number of faults included in the fault history is shown in the value line of the main page **(H1→Hn⁰)**. The order of faults is indicated through the place indication on the top left corner of the screen. The last fault is indicated by F5.1, the penultimate fault, F5.2, etc. If there are 30 faults not deleted in the memory, the next fault will delete the oldest one.

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If you press the *Enter push button* for 2-3 seconds, the fault history will be restored. The number of the symbol Hn^{o} will change to **0**.

10. MAINTENANCE AND TROUBLESHOOTING

10.1 Maintenance

	Only a qualified electrician may carry out the maintenance work. There is risk of electric shock.
	No maintenance must be given unless the unit is reliably isolated from AC and DC power sources.
	Safety instructions included in chapter 1 must be followed.

Maintaining the solar inverter VACON 8000 SOLAR is simple. It is recommended that the following checks are carried out at least once a year.

- Visually check the external condition of the inverter, checking mainly the good condition of
- the door and its locking elements.
- Visually check the internal condition of the inverter, checking mainly that wires are correctly
- located, wearing of isolation of wires, lack of hot points on checking the color of terminals
- and isolations. Check also for humidity and the correct fixing of the elements of the inverter.
- Check the tightness of connection screws on the terminals.
- Check that the fans operate correctly. Check if they need to be cleaned.
- Clean the ventilation grids.
- Check that the acoustic noise produced by the inverter has not increased.

If there is something wrong, please contact the installer.

10.2 Troubleshooting

The microprocessor for the Vacon solar inverter continuously monitors the running condition of the inverter and the elements connected to it.

If the microprocessor finds any abnormal running values or that some of the elements do not work correctly, the device issues an alarm signal, if the malfunction does not imply any kind of a safety hazard for the inverter or the installation, and it issues a fault signal if there is any kind of a safety hazard for the inverter or the installation.

Every indication of fault or alarm is shown on the control panel described in chapter 6. In the control panel, the letter A (Alarm) or F (Fault) appears together with the order number of the Fault or Alarm, the fault or alarm code and a short description.

The fault can be reset using the reset push button on the control panel.
Below you can find the fault and alarm codes, their causes and how to solve them.

	THE SOLUTION FOR SOME OF THE PROBLEMS INDICATED HERE IMPLIES TO PERFORM CHECKING INSIDE THE INVERTER, THE WIRES OF AC MAINS OR THE DC WIRES IN THE SOLAR PANELS. THESE CHECKS HAVE TO BE CARRIED OUT TAK ING THE INSTRUCTIONS IN CHAPTER 1 INTO ACCOUNT.
	REPAIR WORK SHOULD ONLY BE CARRIED OUT BY A QUALIFIED TECHNICIAN. THERE IS A RISK OF AN ELECTRIC SHOCK.

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Fault code	Fault	Possible cause	Correcting measures	Auto Reset
1	Overcurrent	AFE has detected too high a current ($>4*I_H$) in the cables		X
2	Overvoltage	The DC-link voltage has exceeded the inverter limit. See User manual. - high overvoltage spikes in supply	- Check DC voltage	X
3	Earth fault	Current measurement has detected that the sum of phase currents is not zero. - insulation failure in cables	- Check cables.	---
4	Inverter fault			---
5	Charging switch	The charging switch is open, when the START command has been given. - faulty operation - component failure	- Reset the fault and restart. - Should the fault re-occur, contact your local distributor.	---
7	Saturation trip	Various causes: - defective component	- Cannot be reset from the keypad. - Switch off power. - DO NOT RE-CONNECT POWER! - Contact your local distributor.	---
8	System fault	- component failure - faulty operation Note exceptional fault data record Subcode in T.14: S1 = Reserved S2 = Reserved S3 = Reserved S4 = Reserved S5 = Reserved S6 = Reserved S7 = Charging switch S8 = No power to driver card S9 = Power unit communication (TX) S10 = Power unit communication (Trip) S11 = Power unit comm. (Measurement)	Reset the fault and restart. Should the fault re-occur, contact your local distributor.	---

Fault code	Fault	Possible cause	Correcting measures	Auto Reset
9	Undervoltage	DC-link voltage is under the inverter fault voltage limit. See user manual. - most probable cause: too low a supply voltage - Inverter internal fault - One of input fuse is broken.	- In case of temporary supply voltage break, reset the fault and restart the inverter - Check the supply voltage. - If it is adequate, an internal failure has occurred. - Check input fuses - Check DC charge function	---
10	Line Sync Fail	Output line phase is missing. Subcode in **T.14**: S1 = Phase supervision diode supply S2 = Phase supervision active front end	Check supply voltage, fuses and cable.	X
11	Output phase supervision	Output line phase is missing.	Check supply voltage, fuses and cable.	---
13	Inverter under-temperature	Heatsink temperature is under –10°C		---
14	Inverter overtem-perature	Heatsink temperature is over 90°C Overtemperature warning is issued when the heatsink temperature exceeds 85°C.	- Check the correct amount and flow of cooling air. - Check the heatsink for dust. - Check the ambient temperature.	---
18	Unbalance (Warning only)	Unbalance between power modules in paralleled units. Subcode in **T.14**: S1 = Current unbalance S2 = DC-Voltage unbalance	Should the fault re-occur, contact your local distributor.	---
22	EEPROM check-sum fault	Parameter save fault - faulty operation - component failure	Should the fault re-occur, contact your local distributor.	---
24	Counter fault	Values displayed on counters are incorrect	Have a critical attitude towards values shown on coun-ters.	---
25	Microprocessor watchdog fault	-faulty operation - component failure	Reset the fault and restart. Should the fault re-occur, contact your local distributor.	---

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Fault code	Fault	Possible cause	Correcting measures	Auto Reset
26	Start-up prevented	- Start-up of the inverter has been prevented. - Run request is ON when new application is loaded to inverter	- Cancel prevention of start-up if this can be done safely. - Remove Run Request.	---
29	Thermistor fault	The thermistor input of option board has detected too high temperature	Check thermistor connection (If thermistor input of the option board is not in use it has to be short circuited)	---
31	IGBT temperature (hardware)	IGBT Inverter Bridge over temperature protection has detected too high a short term overload current	- Check loading.	X
32	Fan cooling	Cooling fan of the inverter does not start, when ON command is given	Contact your local distributor.	---
35	Application	Problem in application software	Contact your distributor. If you are application programmer check the application program.	---
36	Control unit	NXS Control Unit can not control NXP Power Unit and vice versa	Change control unit	---
37	Device changed (same type)	Option board or power unit changed. New device of same type and rating.	Reset. Device is ready for use. Old parameter settings will be used.	---
38	Device added (same type)	Option board added.	Reset. Device is ready for use. Old board settings will be used.	---
39	Device removed	Option board removed.	Reset. Device no longer available.	---
40	Device unknown	Unknown option board or inverter. Subcode in **T.14**: S1 = Unknown device S2 = Power1 not same type as Power2	Contact the distributor near to you.	---
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	- Check loading.	X

Fault code	Fault	Possible cause	Correcting measures	Auto Reset
44	Device changed (different type)	Option board or power unit changed. New device of different type or different rating than the previous one.	Reset Set the option board parameters again if option bard changed. Set inverter parameters again if power unit changed.	---
45	Device added (different type)	Option board of different type added.	Reset Set the option board parameters again.	---
48	Parameter Fault	Parameter Fault	Check parameters value	---
49	Division by zero in application	Division by zero has occurred in application programm	Contact your distributor if the fault re-occurs while the inverter is in run state. If you are application programmer check the application program.	---
51	External Trip	Trip signal from digital input.	Remove fault situation from external device.	X
53	Fieldbus Board	A Fieldbus card in slot D or E has status "Faulted"	Check installation. If installation is correct contact the nearest distributor.	---
54	Slot Communication	A option board in slot B,C,D or E has status "Communication Lost"	Check board and slot. Contact the nearest Vacon distributor.	---
55	SB Board Fault	A systembus card in slot D or E has status "Faulted"	Check the System bus Board	---
59	SB Heartbeat	An inverter is activated as a slave inverter in array configuration without a heartbeat signal on the bus, Hence, no master inverter active.	Check the System bus	---
64	MCC Fault	Contactor acknowledgment is used through digital input and close command is given without response within the time set with parameter "MCont FaultDelay"	Check the main power switch of the Inverter and Acknowledge input.	---

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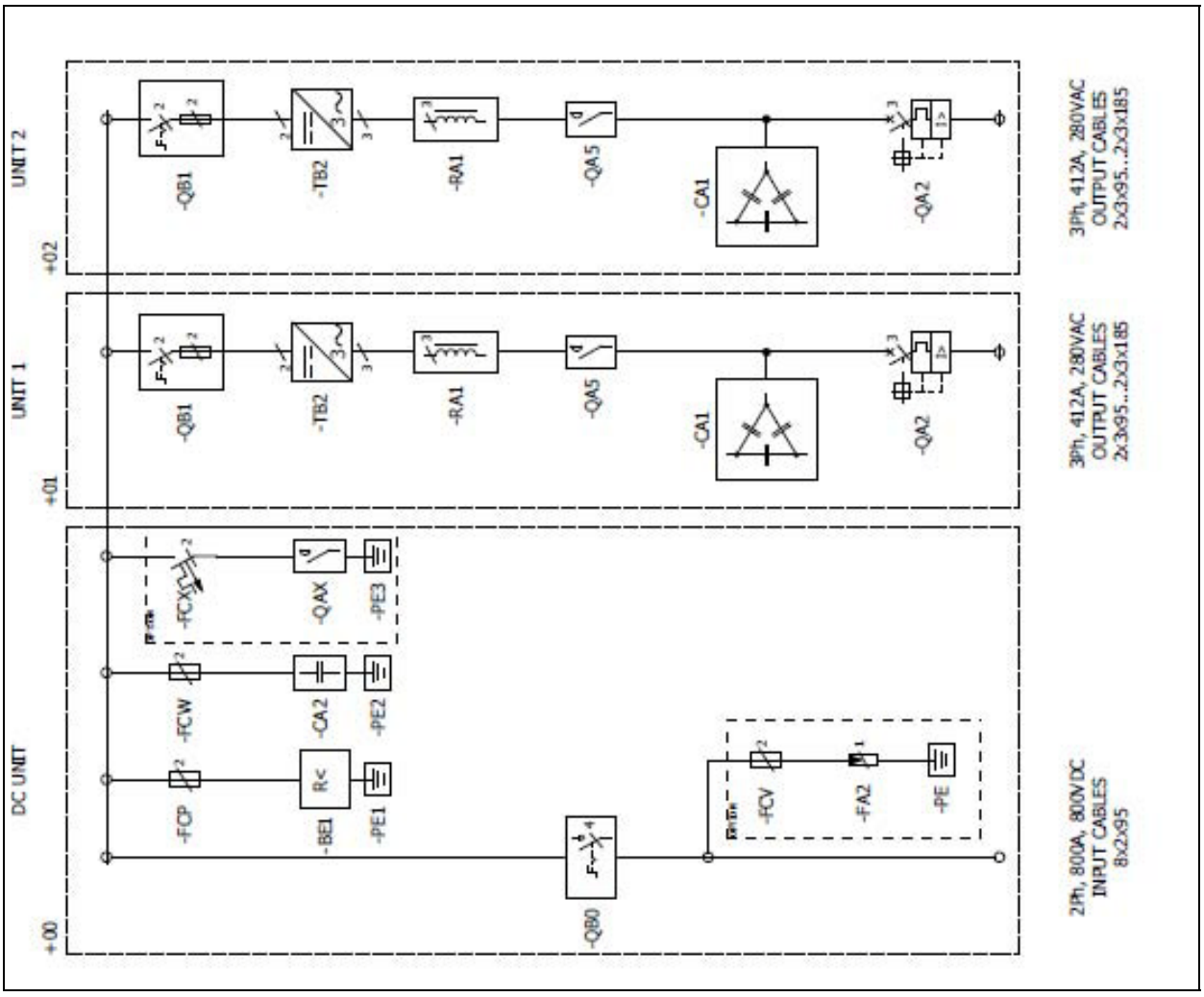
Fault code	Fault	Possible cause	Correcting measures	Auto Reset
70	LCL Temperature	LCL Overtemp trip from digital input.	Check the LCL filter and signal connection. Check fan	---
72	AC VoltMax Trip	AC voltage on line side is above the max limit.	Check AC Voltage	Delayed
73	AC VoltMin Trip	AC voltage on line side is below the min limit.	Check AC Voltage	Delayed
74	FreqOverLimit	AC frequency on line side is above the max limit.	Check AC Frequency	Delayed
75	FreqUnderLimit	AC frequency on line side is below the min limit.	Check AC Frequency	Delayed
76	DC Ground Warning	DC Insulation measurement signal has gone above the warning limit.	Check DC Insulation	---
77	DC Ground Fault	DC Insulation measurement signal has gone above the fault limit.	Check DC Insulation	Delayed
83	Surge Alarm	Surge alarm from digital input.	Remove fault situation from external device.	---
85	Fieldbus	Heartbeat signal from touchpad panel is missing while running in array configuration. Warning = inverter not active Fault = inverter active	Check touchpad panel. Check the control place	Delayed
86	Input Switch	Input Switch in wrong state	Check the input Switch	---
90	High Voltage	Time limit at HIGH voltage level reached. Grid Code	Check grid voltage	---
91	Low Voltage	Time limit at LOW voltage level reached. Grid Code	Check grid voltage	---
92	High Frequency	Time limit at HIGH frequency level reached. Grid Code	Check grid frequency	---
93	Low Frequency	Time limit at LOW voltage level reached. Grid Code	Check grid frequency	---
94	Re Connect Time	Grid has been faulty and Unit has delay when that is reconnection to grid.	Wait 0-10minutes depending Grid standard.	---
95	Emergency Switching	Command for emergency stop received from digital input.	New run command is accepted after reset.	---
97	Power Limit Warning	Power is limited by temperature. Temperature is over 75degrees	Check Cooling systems.	---

11. APPENDIX A SINGLE LINE EXAMPLES

Sample diagrams of multimaster systems

NXV0400 without AC-section



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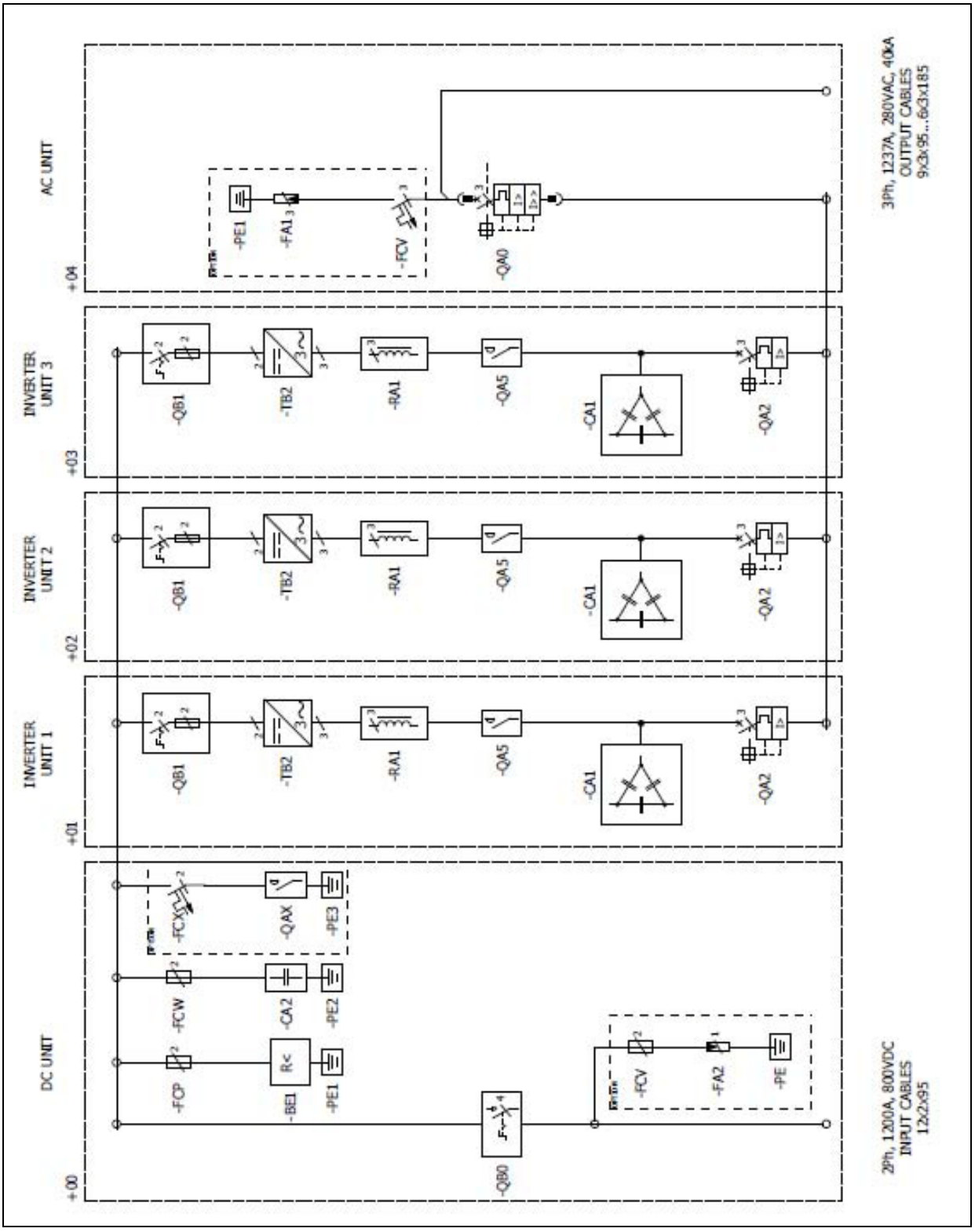
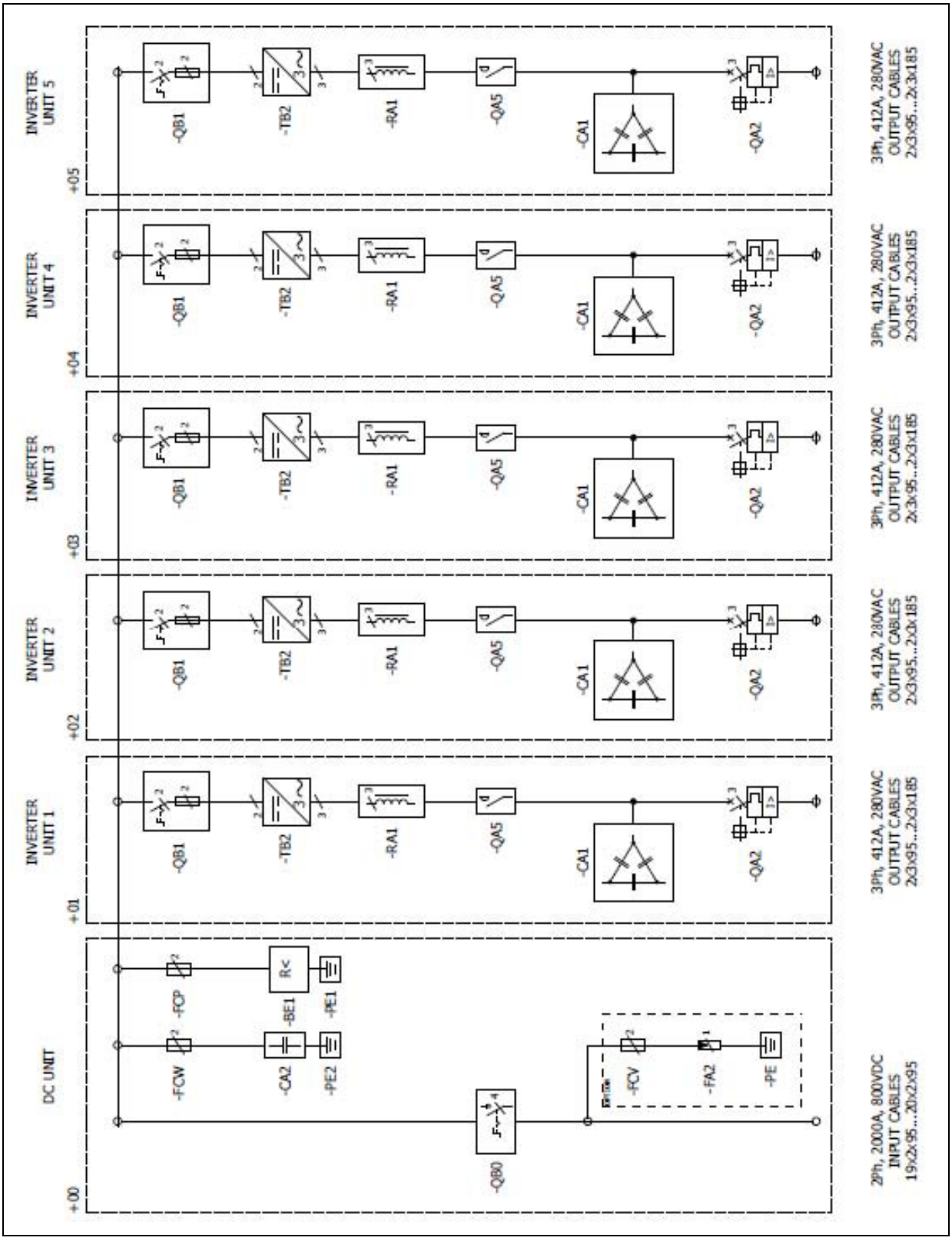
NXV0600 with AC-section

Table 24.



NXV1000 without AC-section



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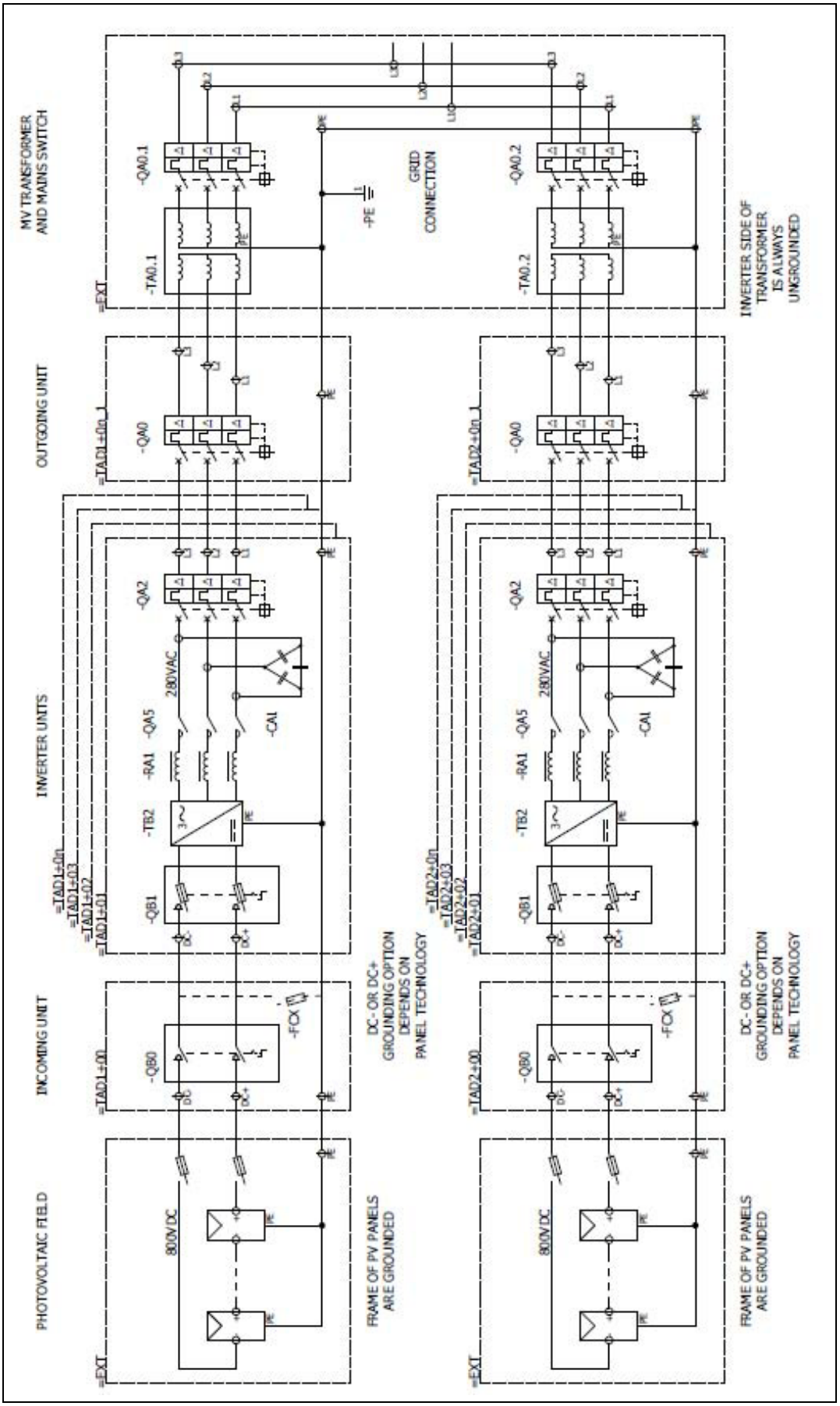
12. APPENDIX B GROUNDING OVERVIEW



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